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VOLUME 88 JUNE, 1914 NUMBER 6

CONTENTS

The Draft Gear Competition

A large number of contributions were received in the draft gear competition which closed on May 15. Because of the number it has been impossible for the judges to thoroughly examine them and come to any decision as to the prize winner in time for publication in this issue. It is expected that all of the papers will be examined within the next two or three weeks and that the prize article will be published in our July number. We wish to take this opportunity of thanking those of our friends who co-operated with us so heartily and effectively in helping to make the competition a success.

Competition on Engine House Work

Remember the competition on engine house work which was announced in the May issue. A prize of $50 is offered for the best article on this subject received before July 15, 1914. The judges will base their decision on the practical utility of the suggestions made or the practices which are described, and space rates will be paid for articles which are accepted for publication but do not win the prize. There is no restriction placed on the subject chosen, but it must be along the lines of the handling of running repairs to locomotives in roundhouses. A number of suggestions were made in the original announcement, and among these was the subject of the organization of forces. The perfecting of an efficient organization in an engine house is a difficult matter, and any light that can be thrown on a means of accomplishing this will be greatly appreciated by many engine house foremen and others. There are foremen in this country handling large engine houses successfully who should be able to write a very interesting and instructive article on the organization of an engine house staff.

Ash Pan Air Openings

The principal topic of discussion during the first day of the Fuel Convention was ash pan air openings. The first principle of fuel economy is to consume every particle of fuel as thoroughly as possible. To do this oxygen must be present, and enough of it to combine with the gases emitted from the fuel. In other words, air must be present in the firebox and in the fuel bed. Professor Parr pointed out in his chemical treatise on clinkering and honey-combing, that an insufficient air supply materially aided the formation of clinkers, and that on account of this the ash was not carried to its infusible state. The discussion that followed substantiated his claims and many instances were mentioned whereby honey-combing was eliminated by increasing the ash pan air openings.

Mr. Hatch in his paper on ash pan air openings, showed the advantages to be gained by having these openings large enough, giving instances where they had been found materially deficient. This subject is worthy the serious consideration of all mechanical officers and any improvements made will show returns in increased fuel efficiency.

Economy in Tools

An interesting discussion at the convention of the Railway Storekeepers' Association, held in Washington, D. C., May 18-20, centered on the question of receiving salvage when issuing tools. On many roads the practice is consistently followed out of insisting on a broken hammer or oil can being received when a new one is issued unless there are very good reasons for issuing the new tool without any return. In such cases an order signed by some one in authority must be presented before the new material is issued. It is difficult to understand why some practice of this nature is not more generally carried out. If it were, it is quite safe to say that the number of shovels and oil cans that are stowed away on most locomotives for emergencies would be considerably reduced. A case in point is that of a locomotive which had six scoop shovels in good condition hidden away in various places. If the fireman

of this engine had been compelled to turn in a broken or damaged shovel every time he got a new one it is improbable that this condition would have existed. There are a great many men who seem to have a mania for collecting as many tools of one kind as they can possibly lay their hands on, and another means of preventing such accumulation is that of checking up the equipment on locomotives periodically. Such a checking should not be made merely with the idea of removing all excess tools but also to see that each locomotive has a proper equipment of tools. There are plenty of locomotives that have no tools of one kind, while others have several of the same kind, and if a proper distribution were made it would not only place all of the enginemen in better position in case of trouble while on the road, but by distributing the tools where they are needed, would avoid the necessity of tools being drawn from the store department to complete the locomotive equipment.

Studying the Distribution of Power

In his opening address before the International Railway Fuel Association at the convention held in Chicago, May 18 to 21, President Collett touched briefly on the careful and studied distribution of locomotives to different parts of a railway to secure the best results. The Frisco, with which Mr. Collett was until recently connected, has had remarkable results from such methods of power distribution, developed largely under his direction.

It is difficult to understand why more roads have not gone more deeply into this question. For example, there are locomotives on almost any railway traversing a bad water district, which give much less trouble than others when using this water. Would it not, therefore, be the logical move to assign as many locomotives of that class as were available to the bad water district, transferring the others to districts with a better quality of water? We have in mind a case in which several locomotives of a class that caused much trouble by foaming, were operated on a district where the water was of a nature that greatly aggravated this trouble. It was impossible to work them more than one round trip without a washout, or at least a change of water. There was another class of locomotives on the road, noted because of the absence of trouble from foaming. These engines were slightly less powerful than the others, and for that reason the operating officers refused to assign them to that district, regardless of the fact that the larger engines could not at any time be worked to their full capacity because of foaming, and in no instance got over the road with full tonnage without having to double several times.

Another practice which does not make for economy is the use on a locomotive of coal radically different from that for which the engine is drafted, without making any alterations in the grates or front end arrangement. The usual result in such cases is a repetition in the roundhouse work book of the report "engine not steaming," until the foreman, employing a method of "cut and try," gets the nozzle tip small enough by bridging or bushing, so that a sufficiently violent draft is created to make the engine steam in spite of the nature of the coal. In one instance of this kind, the road foreman of engines had the tip reduced from 4½ in. to 3⅝ in., with the result that the engine steamed; but the effect on the hauling capacity can be readily imagined and needs no enlarging upon. Either the locomotive should not have been assigned to a division where it was necessary to use coal of such quality, or it should have been carefully redrafted and different grates installed, if necessary, to insure the obtaining of maximum economy.

There may be, and probably are, locomotives that will do reasonably good work under considerably varying conditions. Some roads have standardized designs that are used with slight changes over an entire system; but it must be remembered that these engines were designed only after a careful study of the conditions over the entire road, and that these conditions were given due consideration in the designing. Even then it is seldom possible to produce an engine that will satisfactorily meet the requirements of every division without some alterations being made.

It should not be expected that all locomotives will work equally well under all conditions and by bearing this carefuly in mind in making power assignments, much more satisfactory results may be obtained.

The Fuel Association

The sixth annual convention of the International Railway Fuel Association, held in Chicago last month, was one of the best conventions the association has held. This organization is peculiar in that it aims to interest everybody having anything to do with fuel on railroads. It therefore includes in its membership coal mine operators, fuel experts, railway fuel agents, fuel inspectors and those men whose duties have to do with the consumption of fuel. Naturally with such a membership, the fuel situation is viewed from a number of different angles, although there are some problems that are common to all. The task, therefore, of choosing subjects that will interest and be of value to the entire membership is difficult, and the association is to be congratulated on the success with which it met this condition. The subjects taken as a whole, were broad enough to be of interest to all of the members, and at the same time specific enough to give detail information to those who desired it.

Some members believed that this year's program contained too many papers to permit of thorough discussion within the time allowed, and it was suggested that a lesser number be presented next year. There is no question but that this is a good plan. Other associations have followed this practice with very good results. It gives the members an opportunity to thoroughly digest all of the subjects to be presented before they reach the convention and to formulate ideas to be offered in the discussion of the papers. The discussion of papers presented at a meeting of this kind is of great importance, and, in some cases, more important than the paper itself; so that everybody should be given an opportunity to add what they can from their own experience. Further, they should come to the convention fully prepared to offer something of value on the subjects under discussion. No member should be guilty of saying "I have nothing to say on the subject; I came to listen," when requested by the chair to make some remarks. Such persons might as well say, "I came to hear what other roads are doing in this respect, but what we are doing we will keep to ourselves." A broad, intelligent discussion is the life of the association and every member should do what he can to increase its value. As a member he owes it to the association.

Maintenance of Draft Gear

A master car builder, who has given much time and observation to the study of the draft gear problem, in commenting on our competition which closed on May 15, suggested that far too little attention is given to the proper upkeep and maintenance of that part of the equipment. One of the most imporant functions of the draft gear is to protect the car from damage in transmitting and absorbing the pulling and buffing stresses. It is therefore of prime importance that it be kept in good condition and that such repairs or replacements as are necessary from time to time be made promptly. The draft gear, unlike most of the other important parts of the equipment, is located where it is difficult to inspect it, and especially to observe its action under working conditions. Because it is out of sight, little thought is given to it unless its condition becomes so bad that serious damage is done to other parts of the car. Then it is immediately condemned because of its failure, although such failure might easily have been prevented if the gear had been in-

spected more regularly and more carefully, and a few slight adjustments had been made to compensate for the wear and deterioration.

When wheels are applied to a freight car it is with the expectation that they will have to be renewed in a period of five years, or less. Different parts of the air brake are periodically inspected, and cleaned and repaired at a heavy expense. And yet in spite of the severe demands made upon it the draft gear is expected to do duty indefinitely without wear or breakage, and if it fails it is severely condemned. The master car builder referred to above, after making a careful check, has come to the conclusion that the draft gear should be overhauled after it has been in service about five years. If done at this time the conditions are such that the expense will be less than if a longer period is allowed to intervene and greater insurance will be afforded the car and its lading. If thoroughly overhauled and readjusted it is expected that the gear will continue in service for another four or five years without any very great amount of attention.

General Officers and the Drawing Office

It will be generally admitted that the average railroad drawing office takes considerable time in turning out work. This may be due to lack of organization; and in some cases it is undoubtedly due to this cause, in part, but all railroad drawing offices are not poorly organized, and even where the organization is not what it might be, there are other causes contributing to slow accomplishment of results. There may be, and probably are in many cases, more than two such causes, but there are two which will probably appeal to anyone familiar with drawing office methods as being among the foremost—the haphazard way in which higher officers demand information from the mechanical engineer, and the switching from one job to another, which is necessary in order to furnish the information.

When information is required by railway commissions, or for use in answering questions at investigations, the entire drawing office staff, or a great part of it, as a rule, has to be concentrated on the work and other matters set aside until it is completed. It is conceded that such conditions will seriously disorganize the routine work, and unfortunately such conditions, due to the activity of the various commissions, have very often been the rule rather than the exception. But aside from such conditions, which at the worst are but temporary, general officers frequently use little or no judgment or consideration in making demands on the drawing office. It requires but little search to find examples of important work being entirely dropped for several days to prepare information which has been requested "at once" by a superintendent of motive power or a vice-president, and which, after it has been furnished, lies unused for weeks or months. It may be urged that the officer concerned believed when he made the request that it was urgent. Probably he did; there are times when such conditions are bound to crop up; but they should not be allowed to do so every day, as they do on some roads. If some of our higher officers would endeavor to instill into themselves and their own office staffs some of the ideas as to efficiency which they are constantly urging on their subordinate officers, conditions in this respect would be much improved.

The second cause for waste of time is largely a product of the first. Taking draftsmen away from work on which they have their minds concentrated means, aside from the time taken in accomplishing the other work, a waste in getting settled down again when it is finished; and when the second job, as is sometimes the case, hangs fire, a man may have several jobs on his hands at once and be continually shifting from one to another, a condition which is productive of much lost time. This can, however, be avoided to a considerable extent by keeping a portion of the staff on the larger jobs and assigning the less important work to others who are kept free from heavy assignments purposely for handling short jobs and preparing information for hurried demands. This also provides a good means of training men for later assignment to the more advanced designing and testing work, when vacancies occur.

NEW BOOKS

Hand Book of United States Safety Appliance Standards for Freight Cars. Bound in paper. 32 pages. Size 4 in. by 6 in. Published by J. D. MacAlpine, Cleveland, Ohio. Price, 10 cents per copy; 75 cents per dozen copies; $5 per hundred copies.

This pamphlet is a copy of the safety appliance standards issued by the Interstate Commerce Commission, and was compiled with the idea of presenting these standards in a convenient form for car inspectors. The book is well indexed and contains plates showing the application of various standards.

How to Build Up Furnace Efficiency. By Joseph W. Hays, combustion engineer. 125 pages. 4¾ in. by 7¼ in. Illustrated. Published by Joseph W. Hays, Rogers Park, Chicago, Ill. Price $1.

This is intended as a handbook of fuel economy and is the seventh edition published. The book is written in a breezy manner and anecdotes are frequently used for the purpose of illustration. The chapters deal with such subjects as Why and How Fuel Is Wasted, How to Determine Fuel Waste, How to Stop It and How to Keep It Stopped.

Structural Design. By Horace R. Thayer, assistant professor of structural design, Carnegie Institute of Technology, Pittsburgh, Pa. 228 pages. 6 in. by 9 in. Illustrated. Published by D. Van Nostrand Company, 25 Park Place, New York. Price $2.

This is a second edition, revised, of volume one and considers the elements of structural design. The author has endeavored to develop a book which logically connects mechanics and stresses on the one hand and structural design on the other. This gap in the past has usually been filled by lectures, notes and personal explanations on the part of the teacher. Volume two, which is now in preparation, will apply these principles to the design of simple structures such as I beams, spans and plate girder bridges. This will be followed by a third volume on such advanced structures as cantilevers, movable bridges, suspension spans and arches. The whole series will be uniform in style and treatment. It is intended throughout to combine theoretical and practical considerations, giving each its due emphasis, at the same time preserving an order and arrangement which render it a desirable text.

The Fuels Used in Texas. By William B. Phillips and S. H. Worrell. 269 pages. 6 in. by 9 in. Illustrated. Bound in paper. Published by the University of Texas, Austin, Texas.

This is bulletin No. 307, issued by the University of Texas. The reason for offering the publication is based on the fact that while Texas has large supplies of good and cheap fuel it is not utilized to the best advantage. The production of coal, lignite, natural gas and petroleum does not nearly keep pace with current demands nor promise well for the future. The workable area of coal in the state is 8,200 square miles, with a possible addition of 5,300 square miles. The workable lignite area is 50,000 square miles, with a possible addition of 10,000 square miles. A special feature of the coal industry in Texas is that by far the greater proportion of the product is used for railroad purposes, only a small proportion going into domestic use. The book has a number of excellent half-tone illustrations and contains a large number of tables giving the composition of the various Texas coals and lignites. Considerable space is also devoted to the briquetting of Texas lignite, as well as its distillation for the recovery of by-products.

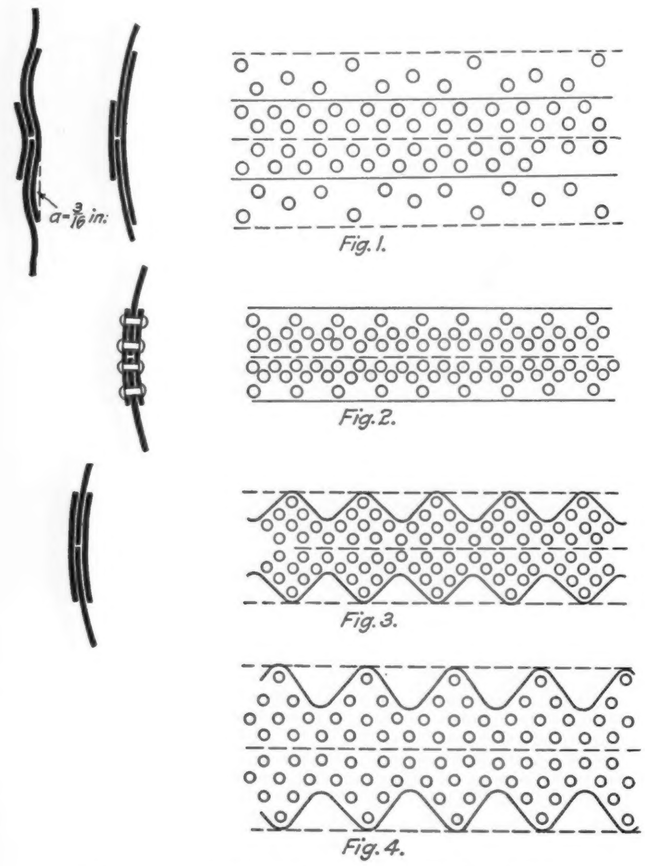
COMMUNICATIONS

REDUCING THE WEIGHT OF BOILERS

Boston, Mass., February 9, 1914.

To the Editor:

No American horizontal return tubular boiler built with butt joints has exploded, I believe, in the joint, but two, to my knowledge, have cracked at the edges of the joints sufficiently to cause leakage. The pressure was immediately reduced and explosions thus prevented. I shall not be suprised to hear of more cases, and there may be a few explosions. The reason for the trouble with butt joints is that, as usually designed, they possess a feature which causes bending of the plate with changes in pressure, as in the case of a lap joint, but to a smaller extent. They are so designed that they are not equally strong on both sides of the plate, and the joint bends as the pressure increases, and returns as it decreases. Some years ago I designed several wide joints and tested them to destruction on the large machine at the Watertown Arsenal. They were so wide that it required



Recommended Arrangement of Riveted Joints

from 350,000 lb. to 450,000 lb. to break them. While under strain they always took the form shown in Fig. 1 and the distance *c* was about 3/16 in. when they broke. I did not appreciate the significance of this behavior at the time, and not until the cracking of the plates in the two butt joint boilers referred to did this dawn upon me. The one-sided feature of the joint caused the bending, the bending caused the cracks, and the cracks would have caused explosions if they had not been detected by the escaping steam.

Since these cracks occurred I have always required the butt straps of boilers on the opposite sides of the plates to be of the same width and the rivets in double shear. Furthermore, I have made the straps as narrow as possible in order to have the rows of rivets as near together as practicable so that the inside strap, which is not caulked, would have small opportunity to straighten out, due to the curvature of the shell, between rows of rivets. I have always made inside straps very thick to diminish this action.

Figs. 2 and 3 show such joints as I advocate, Fig. 3 showing the better design. The latter joint can be made with an efficiency of 92 per cent. or more. The joint in Fig. 1 can be theoretically of this efficiency, but its one-sided feature renders this misleading.

I received my first knowledge of the type of joint shown in Fig. 3 from the illustrations of the boilers of the steamship *Kaiser Wilhelm der Grosse* which were published in *Engineering* nearly twenty years ago. This is illustrated in Fig. 4. The fault of this design is that the straps are too wide and the rows of rivets parallel to the axis of the joint, too far apart.

I have treated this matter at some length in order to lead logically to the conclusion that the plates of the cylinders of boilers can be made thinner than usual by the use of a non-one-sided or symmetrical butt joint. F. W. Dean.

WHY COLLEGE MEN LEAVE RAILWAY WORK

Los Angeles, Cal., February 21, 1914.

To the Editor:

I know quite a number of college men who entered railroad service; some were well adapted to the work and some were not, but with few exceptions all are now in other businesses.

One young man, of the best type for railroad work, well liked and even complimented by his fellow workmen as having good ideas, left after three months' service, giving as a reason that "a college man is foolish to remain with a railroad; there is no future under the present conditions."

Another stayed one year, half of which time was spent on a bolt cutter and nut facing machines. On asking for a change the foreman told him to "work where I put you." Who wouldn't leave under those conditions?

Another young man, a graduate of one of the best engineering colleges along railroad lines in the United States, bright and ambitious, climbed the ladder till he was one rung below the master mechanic when conditions were set up with which he was unable to cope.

Still another, who had excellent experience in various departments on different roads, was holding a foreman's position. This man was well up on shop work and money-saving devices. The road using his services was very far behind on many things. In talking to the superintendent of shops one day in an off-hand way he suggested an improvement which had been tried out elsewhere and found to be very successful. The superintendent had no desire to hear the suggestion. In a few months a device was put into operation which was much inferior to the one outlined by the foreman.

These are only a few examples I have had brought to my attention. These men failed in railroad work because they were with the wrong company. E. L. Dudley.

ELIMINATE YOUR METALLIC PACKING TROUBLES

Chicago, Ill., April 11, 1914.

To the Editor:

In looking back over a good many years' experience in the metallic packing line, both as a manufacturer of metallic packing rings and as a user of them, the thought strikes me that if metallic packings were only given a fair show, much greater mileage would be obtained, and the complaints would be much fewer. The writer has seen within the last twenty years many new metallic packings that were put on the market and a great many that were not. If the few good ones were used right how much easier the life of the packing man would be, and consequently the poor over-worked railroad man would have less cause to complain.

This is the day of specialists. We have all kinds of specialists on railroads, except a packing specialist. The writer knows of only a few roads where the matter of metallic packing, its

application, etc., is dignified by having a specialist attend to it. On these roads they have no packing troubles to speak of, not even with superheaters. Occasionally, of course, a packing will blow, but usually it is a case of the packing being pretty well worn out and a set of new rings will cure the trouble. But how about the other roads where anybody and everybody, and usually nobody, attends to packing matters? Those are the roads that give the packing man all his troubles and gray hairs. He is called in usually as a case of last resort and his packing is blamed for all the troubles. He scratches his head and tries to reason out why his packing works well over on the *A.* road and not here. Finally, when he lands in the roundhouse and calls for cases where his packing has apparently fallen down, he finds that a helper had applied the packing and a handy man had made the cups. The cups were new when applied and so, of course, they must be right, the roundhouse foreman argues. "Well, let's see your cups anyway, just so we can make sure," says the packing man. When he tries his gages in the cups he finds the angles off 5 or 6 deg., the cups much too large, and a few other things of a like nature. The packing man instructs the back-shop to make the cups to a fixed standard and gage; then he gets the consent of the division master mechanic to have a regular machinist attend to all packing matters and see to it that a good packing is selected for the job. At his next visit to the shops he finds that his packing is giving satisfaction and everyone happy.

It is a matter of education, and if the officers would pay a little more attention to these matters much better results would be obtained. A. E. M.

WIRING FOR ELECTRIC HEADLIGHTS

Sacramento, Cal., March 31, 1914.

To the Editor:

I have read with interest and pleasure Mr. Kropidlowski's reply on page 115 of the March issue to my criticism of his headlight wiring diagram. Putting the small chip of wood between the brush and the commutator would put out all the lights, including those in the cab, the number light and the classification lamps, if these were electric, and a little grit on the chip of wood would do considerable damage to the commutator in a very short time. Furthermore, it would be very much easier to shut down the headlight dynamo by closing the throttle than to crawl out of the cab and up to the dynamo to insert the chip of wood, the results being the same.

As to the contact between the arc lamp carbons being intermittent and causing the pilot lamp to flicker, I was calling attention to the conditions with the engine standing on a siding at which time there would be no jarring and the pilot lamp would burn steadily as soon as the arc was cut out if the wiring were arranged as indicated by Mr. Kropidlowski.

W. E. Johnston,
Chief Draftsman, Western Pacific.

[Mr. Kropidlowski's reply to this letter is given below.—Editor.]

Winona, Minn., April 22, 1914.

To the Editor:

I am sincerely grateful to Mr. Johnston for bringing out the points he has. However, I still do not feel that they make my system of wiring unsatisfactory. It is for the one selecting a method of wiring to decide which would be best suited for his purpose, and which features he is willing to sacrifice, simplicity of wiring or a few minor conveniences.

I agree that the use of the chip is not the best practice, as there are always careless men who would not see to it that the chip was clean; also that the same purpose could be accomplished by closing the throttle, but the throttle should not be shut off any more than is necessary on account of condensation accumulating in the turbine, where it is injurious to the blades. As to the engine men remaining in darkness, I think this was answered in my previous letter.

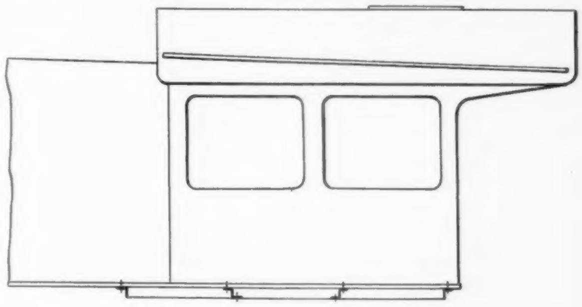
Regarding the incandescent pilot lamp flickering when receiving current through the arc lamp carbons, I know from experience that it will not burn steadily even though the locomotive is standing still. The slight vibration due to the exhaust of the air pump etc., will cause the arc lamp carbons to break and make contact. V. T. Kropidlowski.

STEP FOR LOCOMOTIVE RUNNING BOARDS

New York, N. Y., April 14, 1914.

To the Editor:

Boilers on modern locomotives are in many cases so large that the front doors of the cab are too narrow for a man to pass through. It is therefore necessary to climb along outside of the cab to reach the running boards. Often the only provision for doing this is the projection of the cab floor outside the cab a half inch or so. A good step may be easily and cheaply provided by



Step Under Cab Running Board

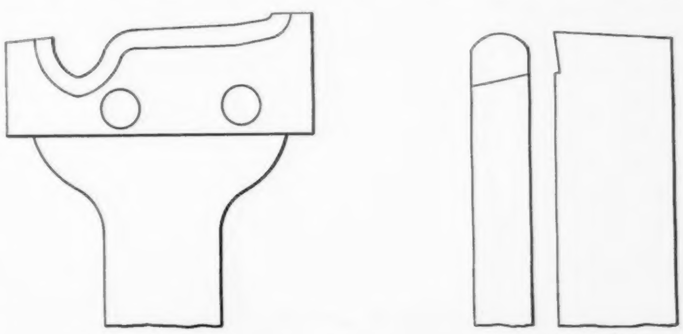
placing a strip of steel 3 in. below the cab floor and flush with the side of the cab, as shown in the illustration. Whether the front door is passable or not this is a convenience in cleaning the windows. Usually the water shed above the windows may be used as a hand rail, but if out of reach a small rail can easily be provided. William G. Landon.

TURNING DRIVING WHEEL TIRES

Richmond, Va., March 21, 1914.

To the Editor:

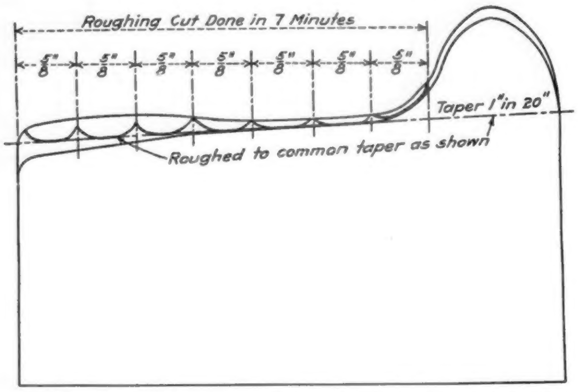
I have read with a great deal of interest several records of locomotive tire turning on this and other roads, published in the Mechanical Edition of the Railway Age Gazette. We have in our Seventeenth street shops, Richmond, Va., a lathe of the same type as that used at Clifton Forge, Va., and the



Tools Used in Turning Driving Wheel Tires

Huntington, W. Va., shops, whose records for turning driving wheels were published in the December, 1913, issue on page 640, and in the February, 1914, issue on page 61, respectively. In a test on this work made on March 18 under the supervision of our general foreman, S. C. Moss, we turned four

pairs of 56 in. driving wheels in one hour and fourteen minutes, or an average of 18½ minutes per pair from floor to floor. The quickest time from floor to floor was 17 minutes. The average time for putting the wheels in the lathe was a little less than 4 minutes, and the average time for taking the wheels out of the lathe was an even 2 minutes. The machine used was one of the latest types of heavy duty driving wheel lathes manufactured by the Niles-Bement-



Method Followed in Turning Driving Wheel Tires at the Richmond Shops of the Chesapeake & Ohio

Pond Company, and was driven by a 50 horse power A. C. motor, which did not give us the advantages of variable speeds which may be obtained where direct current is used. The accompanying table gives the report of tests in detail, and the drawings show the two tools used and the methods of turning the tire. The maximum depth of cut was ¼ in.

Pair No.	Time putting in lathe, minutes.	Time roughing and finishing, minutes.	Time taking out of lathe, minutes.	Time from floor to floor, minutes.	Cutting speed in feet per minute.	Feed in inches.	Diameter of wheel, inches.
1	3	14	2	19	15	⅝	56
2	4	12	2	18	to	⅝	56
3	3	12	2	17		⅝	56
4	5	13	2	20	17	⅝	56

Average time per pair from floor to floor, 18½ minutes.

M. Flanagan,
Master Mechanic, Chesapeake & Ohio.

QUESTIONS FOR CAR DESIGNERS

Meadville, Pa., May 13, 1914.

To the Editor:

Referring to the query in the May issue by W. R. N., relative to the calculation of bending moments in the corners of open door framing, I would consider the data given as incomplete. The nature and magnitude of bending moments in the top and bottom door frame members will depend primarily upon the manner of load distribution to the center and side frame members of the car body.

In car body construction, two general types may be found:

(1) The center girder type in which the center sill is designed to meet stresses due to total car body and lading weight plus the draft gear loads. No load is carried by the side frame.

(2) The side frame or girder type, in which the side sill is designed to withstand stresses due to total car body and lading weight, and the center sills to resist draft gear loads only.

From these two general types various combinations of design can be made. A car of the first type need have the side door top or bottom frame members designed to resist bending moments, due to superimposed load only, and on that account would require door frame members of minimum section.

In the second type, however, the side-door frame top and bottom members would have to be designed to resist total bending moments, due to the weight of the car body and lading at that point. In this type one would expect to find these members of maximum section. A type of car body construction is employed in which the design is of the second type, having side doors located over the trucks. In this case, on account of truck clearances, deep side sills under the side doors could not be used and therefore the bending moments at the door opening are considered as resisted by the center sills at these points.

This type of cantilever construction is used extensively by the Pennsylvania Railroad.

From the foregoing it can be seen that the bending moment to be resisted by the top or bottom door frame members will depend entirely upon the nature of the car body design, and not upon the vertical shear at points on either side of the door. The vertical shear alone is only a criterion of bending moments in so far as we know that where the shear passes through zero or reverses in sign a point of maximum bending moment occurs. I would therefore suggest that W. R. N. determine the bending moment due to total lading and car body load at the door location, and according to conditions distribute this bending moment over the center sills and side framings, with the bending moment assigned to the side frame, considered as resisted by the summated section moduli of the top and bottom door frame members.

R. N. Miller.

WATERING THE RAILS TO PREVENT SLIPPING

Mill Valley, Cal., May 8, 1914.

To the Editor:

The article on page 178 of the April issue brings to mind a road where water on the rails is a necessity. It is the Mill Valley & Mt. Tamalpais Railway in California, and has a grade 8½ miles long averaging 6 per cent and in some places as steep as 8 per cent. There are 281 curves in this piece of track. If the curves were continuous there would be 42 complete circles made. The longest straight piece of track is 413 ft. Shay geared locomotives are used and water is run on every wheel. The water reduces friction on the curves, reduces flange wear, keeps the brake shoes cool and eliminates all wheel squeaking. The locomotive is always kept on the lower end of the train to prevent breaking in two. When the train is being pushed up grade with the cars in the lead, water is forced by the injector to the leading truck of the first car.

Harold S. Johnson.

Abandoning Oil Fuel.—It is announced from Vienna that the authorities of the Austrian North Eastern Railways have decided to give up the use of oil firing on the locomotives, except on those sections of the system where there are steep grades and many tunnels. The decision to adopt oil was arrived at about five years ago, when some 800 locomotives were adapted for burning liquid fuel. The work of converting these engines to coal firing again has already been commenced.—*The Engineer.*

Fast Run in Ireland.—Recently a special non-stop train was run from Belfast to Dublin with the chairman of the White Star Steamship Company, at a speed which constitutes a record for the Great Northern Railway, if not for any line in Ireland. The train was composed of a saloon and a third class van and was drawn by a 4-4-0 type locomotive. The distance is 112.5 miles, which was made in 116 minutes, an average speed of 58.19 miles per hour. Speed had to be reduced to 12 miles per hour on five sections of the line owing to relaying and other operations; to 20 miles per hour approaching Scarva for reverse curves, and at Drogheda on account of a curve and viaduct; and to 30 miles per hour approaching curves at Poyntzpass Station; the train had also to negotiate a heavy incline of 8.5 miles.—*The Engineer.*

Railway Fuel Association Convention

Important Papers Dealing with the Most Economical Methods of Handling and Using Fuel

The sixth annual meeting of the International Railway Fuel Association was held in the LaSalle hotel, Chicago, Ill., May 18 to 21. The convention was called to order by the president, Robert Collett, formerly superintendent of locomotive operation of the St. Louis & San Francisco. After a prayer by Dr. T. F. Dornblaster, President Collett addressed the association.

PRESIDENT'S ADDRESS

The result of the work of this association, in the brief period of six years, has been very gratifying, but its opportunities are so great that we should never feel satisfied. Enough cannot be said to express a proper regard for the work of those few men who at no small sacrifice of their time and energy, built this organization. As a result of these meetings a broader and more comprehensive view is had of the whole fuel problem, and we find the coal man and the railroad man becoming better acquainted.

Recent improvements in mining machinery, especially along the lines of electrical equipment, are giving us coal better prepared on the car. Some improvement has been made in handling through chutes, to secure more uniform fuel on locomotive tenders. We need to specialize more in this direction, and in arriving at the amount of fuel delivered to each locomotive. Any permanent progress along the lines of improved drafting, or for increasing the feed-water temperature before reaching the locomotive boiler, or other devices that will result in causing the position of the locomotive crew to be more attractive, will justify themselves. Recent developments in car design and in the air brake, have made it possible to handle very large trains; the physical ability of the fireman, however, imposes certain limitations on the speed and tonnage.

The proper use of fuel on railroads depends also on other factors. Fuel should be properly prepared for delivery to the engine tank, and a uniform grade of fuel should be supplied where possible. It is fair to assume, where coal mines exist on railroads, that such coal will be used on its locomotives; first, because of lower cost and a constant supply, and second, to stimulate the industry. Efforts should be made to learn to use such coals rather than criticisms made of the quality, as the source cannot be altered. Every semblance of waste should be avoided from the time the coal leaves the mine until it reaches the locomotive tender. If railway managers are shown, concretely, what it costs to operate locomotives not in good condition, the locomotive will not be permitted to long remain in this condition. The proper distribution of engines to divisions to secure the best results, the correct loading of cars and trains, and train movement, should be carefully studied from the standpoint of fuel cost, quite as much as from any other angle. The make-up and schedule of trains is important; it is all along the line of co-operation and needs emphasis.

The plans and specifications for the construction of the modern locomotive are worked out to the minutest detail and when completed it is a magnificent machine. But there lies more opportunity in the finished education of those who are to care for and operate this machine, and not them only, but all whose line of duty affects fuel costs, than was ever known to the builder's art. The time has come when we must conserve our fuel. It is important, in any undertaking, to select good employees; it is especially so in railroad service, and, having selected good employees, the education should be started along fundamental lines at the time of employment. Loyalty should be developed with the other qualifications.

This is an age of co-operation. We are fast learning the lesson that difference of occupation does not imply necessary hostility, and that if we want good service we should cultivate a just pride in duty well done, and should make working conditions as comfortable and, above all, as regular as possible; in other words, cause each employee to be in love with his work. Generally speaking, this is not a difficult problem. Considerable personal observation has convinced me that the average railroad employee desires to do his work in the most efficient manner, but it frequently occurs that he has never had the proper instruction to start him right. Under these circumstances even a willing man is liable to fail, and I believe this will apply to other occupations.

ADDRESS OF DR. GOSS

Dr. W. F. M. Goss, chief engineer, Chicago Association of Commerce Committee on Investigation of Smoke Abatement and Electrification of Railway Terminals, gave an interesting talk on the significance of a pound of coal, stating that in a first class modern stationary plant one pound of coal will produce very nearly one horse power for one hour, while in a modern superheater locomotive it will only produce one horse power for 20 or 25 minutes. One pound of coal used in a freight locomotive will provide enough energy to carry one ton 15 or 16 miles, and in a modern train it will be fed to the boiler every 52 ft. of distance traveled; in other words, if coal were fed to the boiler continuously it would take a rod of coal 3/8 in. square constantly fed into the firebox. In the past the coal production has been doubling every ten years, and if this rate of progress is continued between the years 1910 and 1920 the total production during that time will be equivalent to the production prior to 1910.

In speaking of the work of this committee Dr. Goss mentioned the amount of coal used in and about the city of Chicago. Of 21,000,000 tons of coal or about 5 per cent of the total produced in the country, used in and around Chicago, 1,800,000 tons is anthracite and 3,400,000 tons is coke which comes from eastern sources. Of the bituminous, 4,000,000 tons comes from eastern fields and 12,000,000 from Indiana and Illinois fields. Within the city limits 17,500,000 tons are used per year, a little less than 2,000,000 tons being burned by locomotives. While it is to be expected that locomotives should produce more smoke proportionately to the amount of coal used, on account of the incomplete combustion, the railroads should be congratulated upon the very small amount of smoke they do produce. It has been found that they produce only 20 per cent of the smoke in Chicago. The locomotives in Chicago produce about one-half as much smoke as they do outside of the city limits.

The association was congratulated upon the good work it is doing, and Dr. Goss reminded the members that if they will take care of the pounds of coal the tons will take care of themselves.

HONEYCOMB AND CLINKER FORMATION

The following is an abstract of a paper by S. W. Parr, professor of applied chemistry, University of Illinois:

In studying the conditions of fusibility of the mineral constituents of coal the composition of the ultimate ash product will throw but little light on the subject if indeed it may not be actually misleading. We must keep in mind the fact that there are two stages in the various transformations that are going on. Each stage has its own fusion temperature and these are widely separated, and any study of the final stage will have value only

as it may furnish information as to the possible conditions existing in the intermediate stage of the combustion process. I refer here in the main to the iron pyrites or brasses in the coal. If this material is allowed to burn at a leisurely rate until all of the sulphur has burned out, the resulting product is ferric oxide, $Fe_2 O_3$, and a study of the ash residue in which the iron has reached its final state will not disclose any increased tendency on the part of the ash to clinker.

But studying the iron pyrites in its intermediate stage we find that it very readily parts with one-half of its sulphur content and drops from an indicated composition of FeS_2 to the composition of FeS. This action does not require any oxygen to remove the one atom of sulphur, which is purely the result of heat and takes place at a temperature between 750 and 900 degs. F. Now the further removal of the final atom of sulphur does not take place at any ordinary temperature and, indeed, requires about 1,650 deg. F. for its rapid elimination; or, provided air in sufficient quantity is available, it will burn out to a resulting product of oxide of iron, Fe_2O_3, which is not only highly infusible, but does not add anything to the fusibility of its associated mineral matter in the coal. It is this intermediate stage in the transformation, namely, the iron sulphite in the FeS form, which it seems to me is of vital concern in studying this problem, because it is an easily fusible constituent. Now it must be evident, if conditions are favorable for the formation of this intermediate product, and these conditions are maintained for any considerable length of time, at the high temperatures of the firebox this material will run into clinker.

We have been discussing the tendency towards the formation of clinker on the grate bars. What explanation may that afford for the formation of clinker on the flue sheets? Two conditions must exist in order to furnish any explanation along the lines suggested; first, a chemical condition in which the pyritic iron is transferred only to the ferrous sulphite or FeS stage. We have already said that this transformation may be brought about by heat alone, but it is also true that to remain in the ferrous sulphide stage it must have an insufficient supply of air, otherwise it would continue the process of decomposition until it reached the oxidized form. Chemically speaking, therefore, we need only a moderately high heat and either a shortage in the oxygen supply or such a limitation in the time element that the oxygen action is incomplete.

We should follow the possibilities a step further at this point. If the ash in this half-way condition should be in contact with the higher temperatures of the firebox or be moved into such a zone by stirring or by the movement of the grate, it is entirely possible that large masses of this intermediate material may fuse over on their outer surfaces and thus exclude the further action of oxygen. With a heat sufficiently high, say about 1,600 deg. F., the sulphur is dissociated and driven off. This liberation of the sulphur causes small gas pockets or bubbles throughout the mass, and this is very characteristic of these clinker formations.

The term "honeycombing" itself is somewhat of an explanation of the chemical processes which are going on. Particles of coal which are fine enough to be caught up by the draft have, in the short distance they may travel, about the right conditions as to temperature, oxygen supply, and the time element, to bring them to this intermediate or easily fusible stage. They are thrown, therefore, against the flue sheet in a semi-pasty condition. The outer surface glazes over, and no more oxygen may reach the interior. They are, however, subjected to the most extreme heat of the firebox, sufficient to dissociate the remaining sulphur which thus passes off as a gas, producing the spongy or honeycomb effect. The iron remains behind, it is true, but as *ferrous* iron, and in this form it readily unites with the silica present to form an easily fusible slag. The same ratio of iron to silica, if it were burned to the *ferric* stage, would represent a combination with altogether different characteristics and a very much higher fusion point.

DISCUSSION

From the information brought out by the members' experiences it would seem that the sulphur contents of the coal, the amount of ash, or the condition of the boiler were not the sole reasons for honeycombing or clinker formation. The whole root of the trouble seemed to be in the lack of sufficient air to insure complete combustion. Many cases of bad clinkering and honeycombing have been eliminated by giving the ash pan more opening. It was also stated that where brick arches are used very little trouble is experienced. It was generally conceded, however, that boilers in improper condition; that is, with leaky flues, or full of scale, or with rough projections such as stay bolt heads and roughened ends of flues, would be more liable to honeycomb than if they had been kept in proper condition.

Honeycomb has also been found on oil burners, showing that the trouble was the lack of proper air for combustion in the firebox. S. B. Flagg, of the Bureau of Mines, substantiated Professor Parr's reasoning in regard to the iron pyrites, and stated that the low fusion temperature of the ash was not the sole cause of clinker or honeycomb.

FRONT END DESIGN AND AIR OPENINGS OF GRATES AND ASH PANS

M. C. M. Hatch, superintendent fuel service, Delaware, Lackawanna & Western, read a paper on this subject. The following is an abstract:

The front end is a vacuum pump drawing air and gases through the ash pan, grate, fuel bed, firebox and tubes, discharging through the stack and with the exhaust steam jet from the engine cylinders as its source of power. This pump must be capable of creating and maintaining high vacuums. An engine, recently under test at Altoona, showed a maximum smokebox vacuum of 19.6 in. of water, equivalent to 11.32 ounces. This draft was measured in front of the diaphragm; behind it the draft had fallen to 10.2 in., a drop of 48 per cent; and in the fire, to 3.7 in., a reduction of 81 per cent. This indicates that but 19 per cent of the total draft furnished by the front end vacuum pump was actually active at the fire, and leads us to a necessity of design, i. e., that the losses in draft occasioned by friction in the smokebox should be considered and reduced to a minimum. Excessively long tubes will obviously cause greater differences in the draft head between the tube sheets than will shorter tubes of the same or even less diameter. On an Atlantic type locomotive with 2 in. tubes, 13 ft. 8⅝ in. long, 6 in. of draft back of the diaphragm sustained a fuel rate of 100 lb. of coal per square foot of grate per hour; while on a Pacific type with 21 ft. tubes, 2¼ in. diameter, the same draft burned but 88 lb. of coal. These figures, while not absolutely determinate, indicate what is to be expected when tubes are made very long. A careful consideration of all the data at hand indicates that the ratio of tube diameter to length should be not less than 1 to 110, and that better results will be obtained from large boilers by the introduction of combustion chambers in place of the use of tubes much over 18 ft. in length.

Front ends must have consideration as spark arresters, or more properly, spark killers, as they should be self-cleaning. This means that they must be provided with an ample area of netting or perforated plate, the openings in which will control the maximum size of sparks emitted. The diaphragm must be so arranged that the sweep of the gases under it will carry all solid particles with them, that there may be no accumulation at the bottom of the arch. The drop-stack or petticoat pipe must be so designed and placed as to cause proper cleaning of the table plate.

Front ends must be designed to give equalization of draft through the boiler tubes, and over the entire surface of the fire. They must be constructed, mechanically, in a manner rugged enough to enable them to withstand the punishment in-

flicted by the action of the hot gases, the abrasion of the solid particles of unburned fuel entrained by those gases, and the motion of the locomotive in service.

One tendency of the average engine house force in regard to nozzles should be discouraged, and that is their immediate desire to reduce the size when an engineer reports "engine not steaming." Closing up the nozzle should be a last resort, not to be permitted until all else has been tried and found ineffectual. If the opening must ultimately be reduced, bridges or splits should not be used; bush or change the tip, but leave a free opening for the exhaust jet. Experiments have shown that the more dense this vein of steam, the more efficient it is as a gas remover; therefore it should not be broken up, but should issue free and unrestricted from the nozzle.

All else being equal, the spark discharge is a function of the rate of combustion which is, again, dependent upon draft intensity. If we must burn 120 lb. of average bituminous coal per square foot of grate per hour, we will have a draft, at the fire, of not far from 3 in. of water. A negative pressure of this degree will, no matter how created, cause small particles of fuel to be carried off from the fuel bed and, in the restricted space of the locomotive firebox, these will not be consumed, but will enter the tubes, be discharged into the front end, and thence from the stack. The amount of solid matter discharged from the stack is large and the quantity and fuel value of this loss as ascertained by some recent investigations has been found to vary from 2 per cent and 1 per cent, respectively, at a rate of 2,000 lb. of dry coal fired per hour, to 14 and 12 per cent, respectively, at a rate of 7,000 lb.

Grates.—For the combustion of 120 lb. of coal per square foot of grate per hour in the firebox of a locomotive having 56 sq. ft. of grate area, there will be needed a supply of approximately 25,000 cu. ft. of free air per minute. If we consider that this amount must pass through the grates, that which enters the fire door being neglected, we will find its velocity, when the grate has 30 per cent air openings, must be about 1,500 ft. per minute, and if the air openings in the grate are 50 per cent of the total area, the resulting velocity will be 900 ft. per minute. The principles of efficient combustion will be best served if the percentage of air openings be made as large as possible without causing losses of fuel through the grate. Care must be taken to see that grate bars and grate bearers fit the firebox sheets and each other as they should, that the shaking mechanism is convenient to operate and that it locks the grates level and securely (a tilted finger grate means a burned grate) and that proper attention is given this very important and often slighted part of the locomotive in shop and engine house.

Ash Pan.—The proper theory of ash pan air opening can be

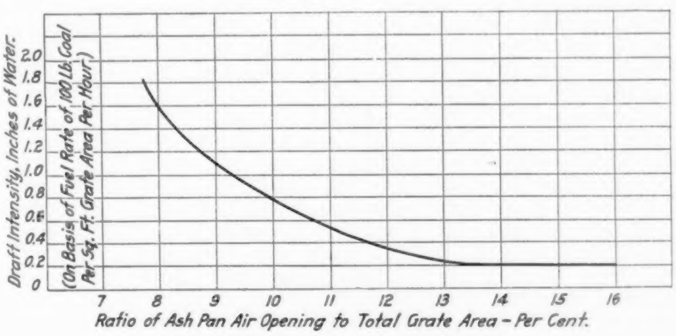


Diagram of Ash Pan Coefficients

enunciated in a few words: Air ingress openings in ash pans should be of sufficient area to ensure the presence of atmospheric pressure under the fire when the grate is working at its maximum fuel rate. The standard practice card of one locomotive builder reads: "The total unobstructed air openings in the ash pan need not exceed the total tube area, nor must they be less than 75 per cent of the total tube area." One of the largest railroads, which has gone into matters of this sort deeper than any other, has established a standard ash pan opening of not less than 14 per cent of the grate area. Prof. W. F. M. Goss concludes, from data gathered at the locomotive test plant at St. Louis, that "It is evident that after a relation of 0.14 sq. ft. of air inlet per square foot of grate was reached, no further decrease of draft occurred when the air inlets were increased; and when the air inlets were less than 0.11 sq. ft. per square foot of grate, the draft necessary to supply air increased very rapidly."

Let us compare the practice of the locomotive builder mentioned above with that indicated by Prof. Goss. Consider an engine with a grate area of 65.8 sq. ft. and a tube fire area of 8.73 sq. ft.

	Air openings in ash pans, square feet	
	Builder	W. F. M. G.
Maximum	8.73	9.21
Minimum	6.55	7.23

The maximum of Prof. Goss, shown to give best results, exceeds the minimum allowance of the builder by 29 per cent. In other words, modern engines working with an ash pan air ingress opening equal to 75 per cent of the tube area have but 0.7 as much as they should have, according to what are at present our most reliable data.

Let us compare the performance of two locomotives with ash pans designed according to the above maximum and minimum.

An engine with 65.8 sq. ft. of grate area had 9.2 sq. ft. of ash pan air inlet, equivalent to 14 per cent of the grate area and, under heavy test conditions, when consuming 130 lb. of coal per square foot of grate per hour with a firebox draft of 3.2 in., had but 0.3 in. draft in the ash pan.

A second engine, tested at St. Louis, had a total tube fire area of 6.51 sq. ft., a grate area of 49.9 sq. ft., and ash pan air inlets of 4.95 sq. ft., equivalent to 74.5 per cent of the tube area and 9.72 per cent of the grate area. This engine, under about the same test conditions as the first, showed, while at a fuel rate of 116.25 lb. of coal, a vacuum in the ash pan of 0.64 in. with 2.22 in. in the firebox.

The accompanying diagram shows ash pan coefficients as obtained at St. Louis and also includes data gathered from later tests. All indications here point to the conclusion that an ash pan air inlet equivalent to 14 per cent of the total grate area will give perfectly satisfactory results.

DISCUSSION

The discussion of the previous paper in regard to the openings in ash pans was directly in line with the position taken by the author of this paper. Exceptions were taken to his recommendations that no bridge should be put in a nozzle; many believed that rather than to increase the nozzle openings a bridge will be sometimes necessary to make the exhaust fill the stack.

G. E. Sisco, of the Pennsylvania, gave the following figures from some tests made by that road:

Nozzle	Draft in front of diaphragm	Evaporation per hour
Round	10.2 in.	43,702 lb.
Rectangular	14.6 in.	49,284 lb.
Elliptical	19.6 in.	58,882 lb.

He also stated that the Pennsylvania is making some tests on a new type of nozzle, which is round with four radial arms extending in toward the center for certain fixed distances. The cross section of these arms is in the shape of a triangle, with the apex downward. In stationary tests these nozzles have given excellent results and are now to be tried out in road service. It was pointed out that this new type of nozzle would give a greater surface with which to entrain more of the gas and act as a better vacuum pump in the front end. It was also stated that the conditions under which stationary tests were made did not give an indication of what the draft would be while on the road on account of the wind action as the locomotive passes along at a high rate of speed.

Mr. Hatch, in closing, stated that on a ten-wheel passenger

engine with 103½ sq. ft. of grate area he has been able to decrease the draft in the ash pan from one inch to one-tenth of an inch of water by increasing the air opening from 3½ per cent of the grate area to 7.75 per cent, or 61 per cent of the flue area to 100.2 per cent. This engine was burning anthracite coal, and he recommended 8 per cent of the grate area for ash pan opening when this kind of coal is used.

UNIFORM METHODS OF COMPUTING FUEL CONSUMPTION

The following is from a paper by C. F. Ludington, chief fuel supervisor, Atchison, Topeka & Santa Fe:

Accounting systems may be uniform, but comparisons between railways are decidedly unsatisfactory, due to vast differences in operating conditions. We may adopt uniform methods of records, but cannot expect uniform comparisons. In advocating a system of fuel accounting I am very much in favor of the plan whereby daily accounts are maintained, enabling the fuel department to intelligently supervise the excessive consumption of fuel by individual trips not to exceed three or four days after the performance is made. The Santa Fe has adopted the plan of figuring fuel performance from the train despatcher's daily train tally sheet, the information being taken direct from the train sheet.

For the first eight months of the fiscal year, which ends in June, 1914, we have decreased fuel consumption $229,012.01, representing a monthly saving on the ton-mile basis of approximately $29,000 over the period where we had already effected a saving of 13.9 per cent. This decrease in fuel consumption has been brought about largely by interesting the individual enginemen in the question of fuel economy through continual agitation on daily and monthly performance records and by personal contact of traveling fuel inspectors and road foremen of engines in an educational way.

There are numerous advantages in daily accounting and records of trip performance, for in addition to keeping the subject continually before the men, it also brings out mechanical defects in the engine with the least possible delay, enabling the mechanical department to keep the engines in better condition, resulting in fewer failures and decreased fuel consumption. When there is no method of telling how much coal has been issued or no effort made to obtain accurate issues, it is not human nature to expect that the enginemen or others will show very much care in the use of it. The Santa Fe has 36 mechanical weighing plants and is displacing all old style shovel and gravity chutes with modern plants of this kind as fast as possible.

The following is the system of accounting used by the Santa Fe:

The fuel used is contracted for and purchased by the general purchasing agent and loaded and weighed under the supervision of fuel inspectors, located at the mines, who report direct to him. The cars when loaded are shown as forwarded on a report made by the station agent at mine stations, or connecting line stations as the case may be, in triplicate, one copy being sent to the mines as a receipt, one copy to the general purchasing agent as a basis for the invoice and the third copy to the chief fuel supervisor for checking against the station report of cars received and unloaded.

A fuel ticket is made out by the engineers in payment for coal taken at fuel stations in triplicate. Two copies are delivered to the fuel foreman in payment for the coal furnished, while the third is retained in a book for the information of the engine crew. One copy of this form is forwarded by fuel foreman with the daily fuel report, while the other copy is retained by him as authority for the issue. The ticket provides the usual information, and in addition train number, time issued and name of engineer and fireman, the fuel foreman certifying to the issue.

A daily fuel report is made out by the fuel foreman at each fuel station, the foreman listing thereon the cars of coal unloaded which is used as a check against invoices and mine reports; the amount of coal in the chutes from the mines, from other stations and from storage; the weight of coal unloaded for storage or other purposes; the cords of wood received; the amount of coal forwarded, and the amount of coal and wood issue for the various purposes. Provision is also made for recording the amount of coal sold. On the reverse side of the report the individual issue to locomotives is shown, in support of which the fuel ticket is furnished. A place is provided for listing the issues according to class of service, in addition to the information as to the names of engineers and firemen, engine number, train number and the amount of coal issued.

Santa Fe.

(Insert name of Railway.)

______ Division.

DAILY TRAIN TALLY SHEET, AND TRAIN DISPATCHER'S REPORT OF TRAIN TONNAGE AND FUEL CONSUMPTION PER 100 TON MILES IN ______ SERVICE. DATE ______ 191__

Train No.	Kind Train	Conductor	Engineer (Initials and Name in Full)	Fireman (Initials and Name in Full)	Engine No.	From	To	Actual Train Miles	Time Called	Time Left	Time Arrived	Time in Service				No. of Stops	Tonnage Leaving						Not to be filled in by train dispatcher				Remarks (If Light Engine show reason for running, etc.)
												Actual		Schedule									Ton Miles	Coal or Oil Consumed	Average Tons per Train	Average Pounds of Coal or Oil per 100 Ton Miles	
												Hrs.	Min.	Hrs.	Min.												

Fig. 1—Daily Train Tally Sheet

E J A &Co. 12-13-13 25M

(Form 1132 Standard)

Santa Fe

______ Engineer. ______ Division.

______ Service ______ District ______ 191__

Average Pounds Fuel per 100 Ton-Mile ______ Average Tons per Train ______

District Average ______ District Average ______ Loss $ ______ Gain $ ______

Date	Train	Fireman	Engine	Station		Miles	Total Miles	Ton Miles	Total Ton Miles	Pounds of Fuel	Total Pounds of Fuel	Remarks
				From	To							

Fig. 2—Record of Engineers and Firemen

A daily train tally sheet and train despatcher's report of train tonnage and fuel consumed as shown in Fig. 1, is made in the office of the division superintendent, the information shown thereon being furnished for fuel statistical purposes, while additional copies go to the car accountant and ticket auditor for check against the conductor's wheelage reports. The report therefore serves various departments. In addition to the usual information shown on train tally sheets we have provided place for information as to time called, time left, time arrived, actual and schedule time in service, tonnage leaving different stations, ton miles, coal or oil consumed, average tons per train and average pounds of coal or oil per 100 ton miles. We do not get absolutely correct tonnage when comparing it with the ton mile statistics calculated in the car accountant's office, for the reason that we do not get all of the tonnage changes, but in comparing these figures we find that there is only from two to three per cent of error and the advantage obtained by having the tonnage figures available in not to exceed three or four days after performance is made, more than offsets the disadvantage of the errors in figures quoted.

This report is made in triplicate. The information compiled by the fuel supervisor shows the pounds of fuel consumed by trips by individuals according to the class of service and is carefully checked for excessive consumption of fuel, taking into consideration the actual time in service and tonnage in the train. These tally sheets are figured and sent to superintendents and master mechanics in from three to five days after the date of the report.

with minimum delay; this means reduction in overtime paid enginemen and trainmen and improved working conditions.

Reduction of terminal delays, both as to engines and trains.

From this it would seem apparent that a properly organized and efficient fuel department is the pulse of the operating cost of a railroad.

DISCUSSION

It was pointed out that the chief purpose of keeping coal records was that of locating the leaks in the use of fuel. The daily reports are of advantage for two prominent reasons: First, because they give an indication of what an engine crew is doing, and serve to create a little rivalry among the men on each division, which will naturally produce good results; and, second, they serve as a basis for starting investigations as to where the extravagent use of fuel is taking place. Provision should also be made whereby the amount of coal used at terminals could be accurately determined.

The practice of the Santa Fe to make their adjustments for shortages or surpluses in the price of coal per engine was criticized by many members, as it would not give a true idea of the cost of operation of the locomotive, and tended to submerge the shortages to such an extent that they would not be given the investigation they should receive.

The Chicago & North Western has followed the practice of having individual estimates made of coal placed on tenders;

Form 1133 Standard

Santa Fe.

(Insert name of Railway Company.)

FUEL PERFORMANCE OF ENGINEERS OR FIREMEN.

________ DIVISION. MONTH OF ________ 191__

	Engine Number	Total Engine Miles	Total Ton Miles	Pounds of Coal or Oil Consumed	Average Pounds of Coal or Oil per 100 Ton Miles	Average Tons per Train	Cost in Cents per 100 Ton Miles	Total Money Loss or Gain Based upon Average Cost per Ton Mile		Pints of Oil		Miles to Pint of Valve Oil
								Loss	Gain	Engine	Valve	

Fig. 3—Monthly Performance of Engineers and Firemen

A loose leaf record of engineers and firemen is also kept, the information being copied from the daily train tally sheet and used in connection with compiling monthly reports as shown in Fig. 2.

Fig. 3 is a record of the fuel performance of the engineers or firemen and is published monthly, blue print copies being sent to all concerned, also to roundhouse foremen for posting on the bulletin boards at terminal points. In compiling the report, care is taken to keep separate the performance according to class of service, the passenger service being further segregated according to trains where there is a large variation in the average weight or where the time is fast. In freight service segregation is made as between through and local freight.

A few of the principal advantages of a daily accounting system which reflect directly on operating costs, are:

Increased supervision over trip performances, resulting in interesting the individual in economical use of fuel.

Better power condition by being able to stop the steam leaks causing excessive consumption of fuel, in five or six days instead of that many weeks.

Reduction of engine failures and the many disadvantages resulting therefrom.

Better train loading, thereby reducing all operating expenses entering into cost of conducting transportation.

Better train despatching, enabling trains to get over the road

that is, the hostler or the coal chute foreman would make one estimate and the engineer another. This has been used for the past three years with practically no trouble. In regard to the weighing of coal placed on tenders, it was thought fully as satisfactory to measure it by volume, and thus eliminate the use of expensive scales for this service.

The daily performance sheet serves as a check on the coal delivered to locomotives and materially reduces the amount of shortage. This practice also will tend to improve the condition of the locomotives and make the enginemen careful about reporting defects so that they may have a better chance to make a good fuel record. The expense of handling these records is believed to be fully warranted by the good results they bring. On the Santa Fe the total expense for this work, including the services of traveling supervisors amounted to only 0.7 per cent of the total cost of fuel.

STORAGE OF COAL

C. G. Hall, fuel agent, Chicago & Eastern Illinois, presented a paper on the storage of coal. The following is an abstract:

The railroads of this country, as consumers of approximately 25 per cent of all the coal produced, are vitally interested in perfecting arrangements for the systematic storage of coal each year.

In storing coal the railroads should plan, so far as prac-

ticable, to move it to the final destination before unloading, to save the use of cars at the time when the coal is to be used. To do this most effectively the coal should be stored at the coaling stations and arrangements should be made to recover it without involving the use of any cars. This can be done by planning the storage space and devices for handling the storage coal at the time the coaling station is installed. A plant to handle up to 20,000 tons of storage coal will cost about $20,000. This plant contemplates the use of a bridge and traveling clam bucket, the coal to be taken out of the cars and placed in storage by means of the bucket, the labor to be performed by the regular coal chute force during the dull seasons of the year, so that the labor cost would be a very insignificant item. The coal is then recovered by picking it up with the clam and delivering it on the conveyor chain which discharges it directly into the receiving hopper of the chute.

By operating such a plant the railroad company would secure the benefit of the reduced expense of moving the coal during the dull period of the summer and avoid to some extent the congestion which prevails in the fall, due to the heavy movement of grain and the abnormal movement of coal.

At the time the railroads are storing the coal, which should be either egg or lump, the mines are producing nut and slack (representing from 38 per cent to 60 per cent of the volume of coal stored) for the commercial market, giving the railroads this additional tonnage at a time when they need the traffic and can move it at the lowest cost. As the distance from the coaling stations to the source of supply increases, so does also the amount of the saving resulting from the storage of coal increase. The expense of unloading and reloading is very reasonable, as the experience of railroads that have at different times stored coal as a protection during strikes or suspension of work at mines develops that the work can be done at a cost of ten cents per ton, including cost of tracks, interest on investment for cranes and all other items entering into the expense. The following shows actual expense of one road for unloading and reloading coal at three different stations during the winter and spring of 1912:

UNLOADING

Station	Tons	Labor	Average cost labor	Supplies	Track	Total cost	Total average
G...........	9,870	$293.23	.0297	$27.10	$179.27	$499.60	.0506
H...........	9,396	285.31	.0304	.....	......	285.31	.0304
T...........	7,373	175.76	.0238	.....	198.77	374.53	.0508
	26,639	$754.30	.0283	$27.10	$378.04	$1,159.44	.0435

RELOADING

Labor	Average	Supplies	Total	Total average	Total cost of handling: Cost	Total cost of handling: Average
$219.87	.0223	......	$219.87	.0223	$719.47	.0729
203.41	.0216	......	203.41	.0216	488.72	.0520
30.00	.0040	......	30.00	.0040	404.53	.0549
$453.28	.0159	......	$453.28	.0159	$1,612.72	.0604

This average cost per ton would have been materially reduced if a greater tonnage had been handled at each point.

Contrary to the common belief, coal does not suffer serious losses when exposed to the elements. Exhaustive tests and researches have been made by the University of Illinois and the Bureau of Mines, and the bulletins issued indicate that the calorific loss on coal exposed to the open air for one year or more is not sufficiently great to make the storage of coal prohibitive.

The disintegration of coal is a greater obstacle to storage than the losses in heat value, as there is no question but that the bituminous coals of this country will slack badly when exposed to the elements six weeks or more This makes the rescreening plant a necessity where coal is stored in large units and subsequently recovered for the market. The ability of railroads and other steam users to procure for storage sizes larger than they ordinarily use, enables them to recover the coal in a satisfactory state for their purposes without rescreening.

When coal is stored in large units great care is required to avoid spontaneous heating. A recent Bulletin of the University of Illinois contains an extensive and complete report, prepared by Professor S. W. Parr and F. W. Kressman, of the results of their experiments and investigation of the question of spontaneous combustion of coal, and all who are interested in this subject should secure a copy of this bulletin. Their enumeration of preventive or precautionary measures to be considered when storing coal are as follows:

a. The avoidance of an external source of heat which may in any way contribute toward increasing the temperature of the mass is a first and prime essential.

b. There must be an elimination of coal dust or finely-divided material. This will reduce to a minimum the initial oxidation processes of both the carbonaceous matter and the iron pyrites. These lower forms of oxidation are to be looked upon as forces, without which it would be impossible for the more active and destructive activities to become operative.

c. Dryness in storage and a continuation of the dry state, together with an absence of finely-divided material, would practically eliminate the oxidation of the iron pyrites.

d. Artificial treatment with specific chemicals or solutions' intended to act as deterrents does not offer great encouragement, though some results seem to warrant further trial in this direction.

e. By means of a preliminary heating, the low or initial stages of oxidation are effected. These sources of contributory heat being removed, the forms of destructive oxidation are without the essential of a high starting temperature and are therefore inoperative. Whether such preliminary treatment is within the realm of practical or industrial possibility could not, of course, be determined within the scope of these experiments.

f. The submerging of coal, it is very evident, will eliminate all of the elements which contribute toward the initial temperatures. As to its industrial practicability, like the conditions under *e* above, it can best be determined by actual experience.

g. Other processes may be suggested by the formulation of the principles involved. Such, for example, would be the distribution throughout the coal of cooling pipes through which a liquid would circulate having a lower temperature than the mass. This would serve to carry away any accumulation of heat and confine the oxidation to the lower stages only. On the contrary the proposition sometimes made to provide circulating passages for the transmission of air currents is of questionable value, since it may result in the contribution of more heat by the added accessibility of oxygen than will be carried away by the movement of the air.

Conclusions.—The storage of coal carried on successfully means:

More regular working of the mines, resulting in lower cost of production, better satisfied labor, more efficient mining methods and a greater percentage of coal extracted.

Equalized movement, enabling carriers to provide equipment and handle at minimum cost.

Avoiding the spasmodic demands for certain sizes, resultant car shortages, boom prices, sharp practices to escape contract obligations, and the general dissatisfaction resulting from the various causes enumerated.

The consumer should receive sufficient concessions from producer and carrier to offset the expense and deterioration incident to storage and withal enjoy a reduction in the ultimate cost.

Confining of coals to proper distance zones, enabling operators to work out nearby fields more thoroughly instead of mutilating them to get out a little cheap coal to meet the keen competition, leaving a greater percentage of coal in the ground in such shape that it can never be recovered.

The accomplishing of more in the conservation of our coal resources than any other one agent.

DISCUSSION

From the discussion it seemed that in the practice of storing coal some members had found no difficulty, while others had found considerable. It was generally believed that coal with considerable slack would not be a good coal to store, and as pointed out in the paper, where the storage of coal is necessary it would be advisable to use large lump, which, when it disintegrated, would not be so small that it could not be used satisfactorily in a locomotive firebox.

Mr. Schaefer, of the Roberts & Schaefer Company, cited an installation for a district in the southwest, where a 50,000

ton storage plant was being built. It is expected that this plant will pay a profit of at least 10 per cent, after 10 per cent for depreciation and 6 per cent interest charges, together with all other costs of operation, have been deducted. This plant is to be stocked in the summer, when the cost of coal is at a minimum, and the coal sold in the winter at the prevailing winter prices.

Where practical it was advised that a good foundation should be made for storage piles, such as reinforced concrete, so that when the pile was cleaned up there would be no dirt and other foreign material picked up. One member reported that coal had been successfully stored, being handled by a locomotive crane at a cost of loading and unloading of about 4.67 cents per ton, with an average depreciation of 2.5 per cent. The kind and size of coal will determine the size of the pile to be made. With slack coal the piles should not be too high, and they should be well ventilated to prevent fires by spontaneous combustion. The coal should also be of low sulphur content. It was believed that good results could be obtained with coal after it had been stored, but different methods will have to be used in firing.

J. G. Crawford, of the Burlington, stated that where possible deep piles should be made, as the deterioration practically only takes place at the top and sides. Tests were made on a Wyoming coal that had been stored four years and it was found that there was practically no loss in heat value, and 18 in. down from the top and 6 in. in on the sides the coal was in as good condition as when stored. The jacking up of tracks over coal piles and running the cars up on the track for dumping was believed to be poor practice, as the slack would settle under the track and create a solid bed, which would be susceptible to spontaneous combustion.

Eugene McAuliffe made a very interesting plea for the storage of coal, stating that by so doing the railroads would receive better service at the mine, being able to get continuous tonnage throughout the year, and much better coal, as the miners themselves, when they found it possible to have steady employment, would be of a more settled nature and more satisfied with their working conditions. It would tend to greatly eliminate the mine troubles that have been so common in the past few years.

SIZING OF COAL FOR LOCOMOTIVE USE

The following is taken from a paper by A. G. Kinyon, locomotive fuel engineer, Clinchfield Fuel Company:

A fundamental law or condition for perfect combustion of coal is that oxygen must touch the fuel burned. Not only must the oxygen touch the fuel burned, but the more intimately mixed the oxygen is with the fuel, the more perfect the burning will be. The smaller the lumps or pieces into which a given quantity of coal is divided, the greater the area exposed to contact with the air. It does not follow, however, that the further this is carried the better the results will be. The limit of the smallness of the size of the coal is fixed by the tendency of the fine particles of coal to lie so closely together as to prevent the free passage of air through the fuel bed, rather than to the light weight of the small particles. But this tendency to prevent the free passage of air through the fire also tends to tear holes in the fire. From the writer's experience in firing different coals under various conditions, it has been found that the best results possible are obtained with coal not larger than 2 in. cubes, and preferably with one inch cubes, and it is his belief that this size will give best results when proper methods of firing are followed. Proper methods of firing are believed to be—having a light, level fire, supplying the coal in small quantities at frequent intervals, and distributing each shovelful over as large an area as possible. This brings up another point which will have to be considered. We know that if a shovelful of very fine coal be thrown upon a brightly burning fire, and spread over a large surface, the volatile matter or hydrocarbons will be evolved instantaneously and there will be little time or chance for them to burn, and much of them will go away in the form of dense black smoke. This, then, is another limiting condition as to the small size of the coal. It is true that by wetting fine coal we can prevent small particles being carried out unburned, but it is difficult to spread wet coal evenly or get it to burn evenly. Not only this, but every bit of moisture in coal must be evaporated before the coal commences to burn, and this takes heat. By this we do not mean to infer that coal should never be moistened; on the contrary, we believe it should be kept moist enough to lay the dust and prevent it from blowing off the tank or into the eyes of the crew.

If we build the fire up to the thickness required to have it burn solidly and evenly with the large lumps, we will have it heavier than it should be for economy. Another objection to large lumps is the fact that it is necessary to put in large quantities at each firing, thus tending to reduce the firebox temperature and possibly bringing it down below the splitting up point of the gases, and they are lost entirely.

Inquiries were sent out in regard to the best methods of preparing coal for locomotive use. Some thought the preparation should all be at the mines and others at the tipple. All agreed that the locomotive was not the proper place to prepare it, at least for hand firing. One correspondent gives $5,000 as the cost of a crusher installed at a mine to crush run-of-mine coal. Quoting the correspondent: "The rolls of these crushers were 30 in. in diameter and 36 in. long, double roll with inserted teeth 2⅜ in. square by 4½ in. long. The size of the chunks would average 12 in. by 12 in. by 20 in. The coal was very hard. The speed of the rolls is approximately 100 r. p. m. The percentage of sized lump when running through the crusher under a test was as follows: Slack (1¼ in. round) 10.2 per cent, lump 78.1 per cent, oversize (12 in. by 8 in. by 6 in.) 11.7 per cent. The crusher handles 100 tons per hour and takes the coal just as it comes from the mine, without any labor cost, and the cost for power is practically nominal, being only $15 for the first month's operation."

The advisability of sizing the coal at the mines or coaling station depends upon the nature of the coal, the number of times it will be handled from the mines to the locomotive tender, and the means of handling it. It is admitted that the fireman gives proper attention to the matter of firing and other duties, such as watching signals, etc., he has no time or inclination to properly break lumps.

Inquiries as to methods of preparing coal for locomotives equipped with stokers that do not combine a crusher in their installation, developed that the preparation was chiefly done by screening. In some cases this was done at the mines and in others at the coal tipples. There is one stoker which will handle either run-of-mine containing 10 in. lumps or slack equally well, having a crushing feature that allows of meeting conditions as they are found, and adding but little to the first cost of the machine and nothing to its complication.

It is the writer's opinion that where coal is machine mined and shot only with powder, the best and cheapest method of sizing for all concerned, will be to pass such coal over a five or six-in. screen. The amount of fine slack coal so mined is negligible and the lumps that pass over the screen can be disposed of for other purposes and at a higher price which will allow a lower price for locomotive fuel.

DISCUSSION

J. W. Hardy, formerly of the Rock Island Lines, stated that there never has been such a need as at the present for properly sized coal for locomotive use. The demands made upon the railroads have so materially increased in the past year, with the heavy cars and increased tonnage trains, all at the same rates that prevailed when these conditions were not required, that this could not be performed economically without a good grade of coal of the right size on the locomo-

tive tender. Coal chutes should be so designed that the coal would remain well mixed and be of the size intended. Purchasing agents should be made to realize the importance of having the right kind of coal and be shown how a difference of a few cents for a ton of coal might make a material saving in the operation of trains.

W. L. Robinson, of the Baltimore & Ohio, mentioned some tests made on that road with the Street stoker on a Mikado locomotive fitted with a brick arch. It was found that 3.7 lb. of coal were used per horse power per hour, with nut, pea and slack, which passed over a 1½ in. screen, while 4.18 lb. of coal were used per horse power per hour for slack which passed over a ¾ in. screen, showing about a 15 per cent difference and giving a good indication of the value of the proper size of coal.

MODERN LOCOMOTIVE COALING STATION

The report on this subject will be published in the July issue. It is signed by Hiram J. Slifer, chairman, E. A. Averill, E. E. Barrett, W. E. Dunham, G. W. Freeland, W. T. Krausch and R. A. Ogle.

FIRING PRACTICE

The report of the committee on this subject consisted of the entire report submitted last year with such corrections as were requested at the last convention. The report is signed by D. C. Buell, chairman; T. E. Adams, W. C. Hayes, A. N. Willsie, T. R. Cook, R. Emerson, O. L. Lindrew, L. R. Pyle, E. C. Schmidt. The following are the changes made in the report of last year:

Firing Tools.—Drawings were presented of shovels recommended, the capacity being from 12 to 15 lb. of bituminous coal. Coal picks were recommended to be about 12 in. long and weigh 4½ lb. Specifications were also presented for a standard rake to be used on locomotives, and for slice and shaker bars.

Other recommendations were included in the new draft of the report, among the most important of which is: "When various kinds of coal are being supplied to engines of a certain district the draft appliances should be designed and adjusted so that the engine can successfully and economically burn any and all of these grades of fuel. In other words, it is not necessary to change the drafting of an engine to burn different grades of fuel successfully."

COAL SPACE AND ADJUNCTS OF TENDERS

The following is from a paper by L. R. Pyle, traveling fireman, Soo Line:

The object of this paper is to show how great a need there is for the coal to be delivered to the fireman all the time. Some may take exception to the statement that a fireman will waste 10 per cent of the coal he handles twice, but from my personal experience and observation while riding and firing engines where coal has to be shoveled ahead, I know that this is not exaggerated.

On large locomotives when the full tractive power is sustained for long periods, the fireman should be giving his entire attention to his work in the cab. Just the minute the fireman has to shovel down coal he ceases to be a fireman, and becomes a coal heaver at $3.75 per hundred miles. All instructions are forgotten and all he thinks of is to shovel coal.

Types of Hoppers.—The sides of the coal space should be vertical about one-third of the way and then slope toward the bottom of the coal space at an angle of 65 or 70 deg. An extension of the coping, curving in over the coal space for a distance of about 18 in., is no doubt a help in keeping coal from rolling off while the locomotive is in motion. Some roads using tenders of large coal space, start the slope in the back from the top of the coping down to the shovel sheet at an angle of about 50 deg., instead of having a vertical back to the coal space. Personally, I think this type is the best on large capacity tenders.

Coal Gates.—Coal gates should be of iron with a supplementary gate on the bottom, which should work on a pivot so that it may be raised or lowered at will. Some prefer the gates in four pieces, which is a good plan when they are very high. There should be hooks or cleats on the side of the coal space to hold the gates open. If the coal is not well prepared and contains large lumps the gate should have openings every 10 in. or 12 in. The inverted V-shaped opening in the bottom of the gate should be about 14 in. high and 24 in. wide. We have found that this opening will allow all the coal to pass through. When the coping is high, an arch or yoke should be placed over the gate to keep the sides from bulging.

Wings or Fenders.—A fender in the gangway helps to keep coal from rolling out, and should be used, if the apron does not extend too far back. In case the fender is not desirable on account of the element of safety the gates may be set back from the front of the water leg of the tender about 6 in., and this will form a shoulder which will act as a fender.

Mechanical Coal Passer.—On one trip while riding an engine equipped with a late type of coal passer, we made one hour and thirty minutes better running time than we could have made had we stopped for coal twice, as would have been necessary with the hopper type of tender. This time was made by being able to make better meets and passing points for passenger trains. Another feature in favor of the passer is that the coal is delivered to the fireman in the best possible condition. There is fresh coal on the tender all the time and the slack and lumps are kept well mixed.

On the tilting type of passer the main trouble reported is that the hinges are weak and break frequently. This may be helped to a great extent by using an oval hole in the hinge, which will make a more flexible joint at the base of the hopper. There are two types of the tilting hopper; one which fits inside the coal space, and one which rests in a bed on the front part of the tender. The latter is much the better type.

The reciprocating plunger type consists of a steam cylinder containing a piston and a rod which is connected to a plunger and a rectangular trough which is placed in the bottom and back end of the coal pit. The width of the trough is practically the same as the width of the coal pit, which is from 4½ to 5 ft.; its sides are 15 in. high, and are provided with flanges overhanging the top of the plunger. Suitable packing is applied to prevent any coal being drawn back of the plunger. The plunger is operated by a lever on the front of the left water leg.

DISCUSSION

The moral effect on the fireman of having labor saving devices, such as the coal passers, will be such as to greatly increase his efficiency and will thus be a step toward fuel economy worthy of the expenditure. It would eliminate the necessity of two firemen where two are ordinarily required. The roads using coal passers report that they are very satisfactory. By their use the tenders will not have to be coaled as often, which in some cases necessitates the haulage of coal to outlying points. The coal is also better mixed, as there is no opportunity for the slack to collect.

PRE-HEATING LOCOMOTIVE BOILER FEED WATER

Monro B. Lanier, vice-president, Norton Coal Mining Company, presented a paper on this subject from which the following is taken:

That material benefit can be derived from pre-heat properly applied is generally accepted; in point of fact there is probably no more potent factor in locomotive efficiency, fuel economy and boiler up-keep. By pre-heat is meant a reclaimed by-product as differentiated from direct heat applied at the expense of the fuel and heat generating plant. The economy to be derived from pre-heat is in direct ratio as the *difference* between the initial and final temperature of the feed water is to the *difference* between the total heat of steam at a given absolute pressure and the final feed temperature. The percentage of saving varies

inversely with the rise and fall of the boiler pressure, increasing as the difference between the feed water temperature and that of the steam becomes less; it follows that pre-heat will show a greater percentage of economy in connection with locomotives operating at relatively low boiler pressure. Passing over other operating advantages, no claim for fuel economy can properly be made for the increase in feed temperature by means of the injector—the boiler being robbed of steam of high temperature and reimbursed with the condensation, the temperature of which averages 140 to 200 deg. F.

In connection with injector fed boilers, pre-heat to be of value must be added between the initial temperature and the final possible delivery temperature of feed water, the former being the injector delivery temperature, viz., 140 to 200 deg. F., the latter being the sensible heat of saturated steam at a given pressure.

We have included a table expressing in percentage the net fuel economy to be derived from pre-heat from different initial feed water temperatures at a given absolute pressure.

Saving of Fuel by Heating Feed Water

(In per cent—Steam 200 absolute, representing 185 gage pressure)

Item No.	Initial Temp. Fahr.	Final Temperature F. 120	140	160	180	200	220	250	300	380
1	32	7.93	9.90	11.96	14.09	16.30	18.61	22.24	28.80	40.92
2	60	5.40	7.34	9.34	11.42	13.68	15.84	19.37	25.80	37.63
3	80	3.60	5.50	7.47	9.52	11.65	13.85	17.34	23.65	35.27
4	100	1.80	3.68	5.61	7.61	9.70	11.88	15.30	21.50	32.92
5	120	....	1.83	3.74	5.71	7.76	9.90	13.26	19.35	30.57
6	140	....	....	1.87	3.81	5.82	7.92	11.22	17.20	28.22
7	160	....	....	....	1.90	3.88	5.94	9.18	15.05	25.87
8	180	....	....	....	....	1.94	3.96	7.14	12.90	23.52
9	200	....	....	....	....	....	1.98	5.10	10.75	21.17
10	210	....	....	....	....	....	.99	4.08	9.67	19.99
11	220	....	....	....	....	....	....	3.06	8.60	18.81
12	250	....	....	....	....	....	....	....	5.37	15.29

In practice, with injectors working full, passing water at 140 deg. F. from a tank temperature of 60 deg. F., an increase of 110 deg. by pre-heat, delivering the water at 250 deg. is probably as high as can be obtained, the final delivery temperature increasing to a limited degree with the increased tank and injector delivery temperature.

To offset in a measure the heat losses incident to boiler feeding through the medium of the injector, we must consider the probability of detracting to a certain extent from the tractive power of the locomotive, at least on heavy grades, by any mechanical boiler feed which would necessarily be a pump.

In modern practice, with boilers operating with steam at 200

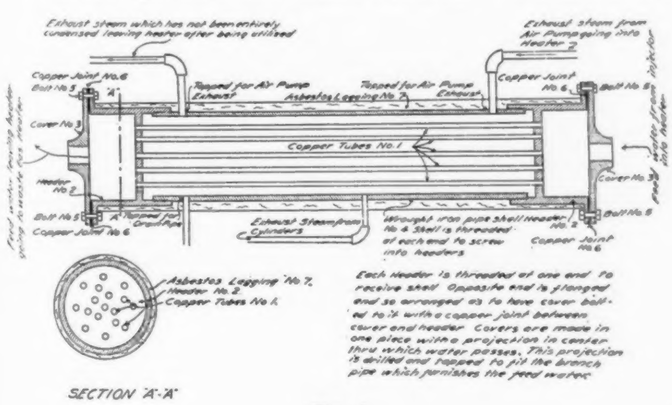


Fig. 1

lb. the metal parts are subjected to high temperature, causing extensive expansion throughout; water suddenly introduced into the boiler at very low temperature causes extreme sudden contraction of the bolts and sheets. The nearer the temperature of the feed water to that of the steam, the less injury will result to the boiler. From a boiler upkeep standpoint alone, pre-heat is of much value and is worthy of careful consideration, especially in view of the fact that the said pre-heat is a utilized waste.

The New Orleans Great Northern is equipping locomotives with a device gotten up in its shops for the purpose of preheating the feed water. The construction and design of this pre-heater is simple, consisting of an auxiliary exhaust heater in connection with a front-end or smoke-box heater operated in tandem. The auxiliary heater consists of a cylindrical shell, Fig. 1, 8 to 10 feet in length, containing a number of copper tubes running lengthwise with the shell; this device is applied on the branch pipe—between the injector and the boiler check—and is connected with an exhaust pipe from the pump. The branch pipe continues from the forward end of the heater through the front end into the lower forward portion of the smoke-box heater.

The front end heater is simply a hollow diaphragm supplementing the regulation diaphragm for each respective engine, yet of the same shape and arrangement with regard to location, etc. The space within the diaphragm is arranged in sections by

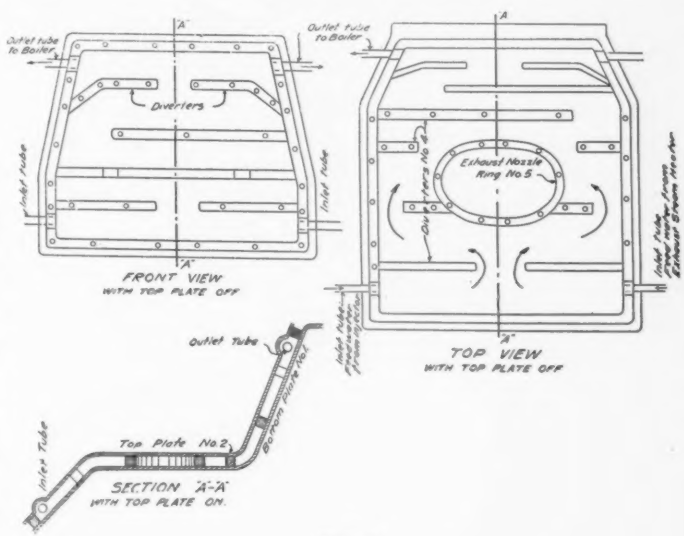


Fig. 2

diverters, placed in such position as to force the circulation of the water over the widest possible area; no set rules are given as to the exact location of the diverters, this being governed by the size and shape of the diaphragm, see Fig. 2.

With the injectors in operation, the feed water passes from the branch pipe through the copper tubes of the exhaust heater, absorbing heat from that steam which is exhausted from the pump into the lower rear end of the shell. The exhaust steam passes upwards over and between the copper tube—the condensation flowing from the lower forward end of the shell through a drain pipe to the ground,—the heated feed water flowing from the copper tubes,—passing through the continuation of the branch pipe—into the front end of the heater—thence upward circulating over the hot flattened surface around and through the diverters, leaving the heater at the outlet—thence through the boiler check into the evaporative section of the boiler.

Line checks are placed in the branch pipe at both ends of the auxiliary heater, an exhaust pipe to the atmosphere relieving the shell of such steam as is not condensed.

A tee on the branch pipe between the exhaust heater and the front end connects with the boiler check, and valves are so placed on both lines as to divert the feed from the front-end heater at any time this may be desired. A connection is made from the lower portion of the boiler to the smoke-box heater, permitting, when opened, the circulation of water from the boiler through the heater.

It is claimed by the mechanical department of the N. O. G. N. that their engines equipped with this pre-heater are operating more economically, that the heretofore poor steaming engines are now kept hot readily and an even pressure maintained; further, that leaky flues, mud ring and broken stay bolts have been reduced to a minimum.

The following observations were made in regard to delivery

temperature from each heater, and the degree of pre-heat obtained under approximately similar working conditions:

Gage Pressure 185 (200 Absolute)

Injector monitor No. 10. Operating	Delivery temperature from injector	Delivery temperature from exhaust heater	Delivery temperature, front end heater	Total degrees pre-heat	Percentage indicated economy
Full open.....	150	195	220	70	6.28 per cent
¾ open	160	200	220	60	5.94 per cent
½ open	180	210	230	50	5.00 per cent
¼ open	210	230	260	50	5.15 per cent
Average	160	200	220	60	5.94 per cent

Many of the Mallet locomotives are equipped with pre-heaters which are practically auxiliary boilers contained within the extension front end. Observations made on the Santa Fe System on operating Mallet locomotives indicated an injector delivery temperature of 190 deg. F. and a final delivery temperature to the boiler of 245 deg. F., a gain by pre-heat of 55 deg. F., representing a saving of approximately six per cent.

The Pere Marquette has a number of locomotives equipped so that the exhaust from the pump is discharged into the tank. An average temperature of approximately 100 deg. is maintained in the tank representing an increased average tank temperature of perhaps 40 deg., which is of some value, the injector delivery temperature increasing appreciably. The apparent difficulty involved in this system is the possibility of heating the tank water to a degree that cannot be handled by the injector, and the bursting of the hose connections.

The problem of pre-heating water seems to have received greater attention in Europe than in America. There are a number of systems of pre-heating in practice on English and Continental lines. One or more of the European devices have been experimented with in this country with more or less success, one of these being illustrated in Fig. 3.

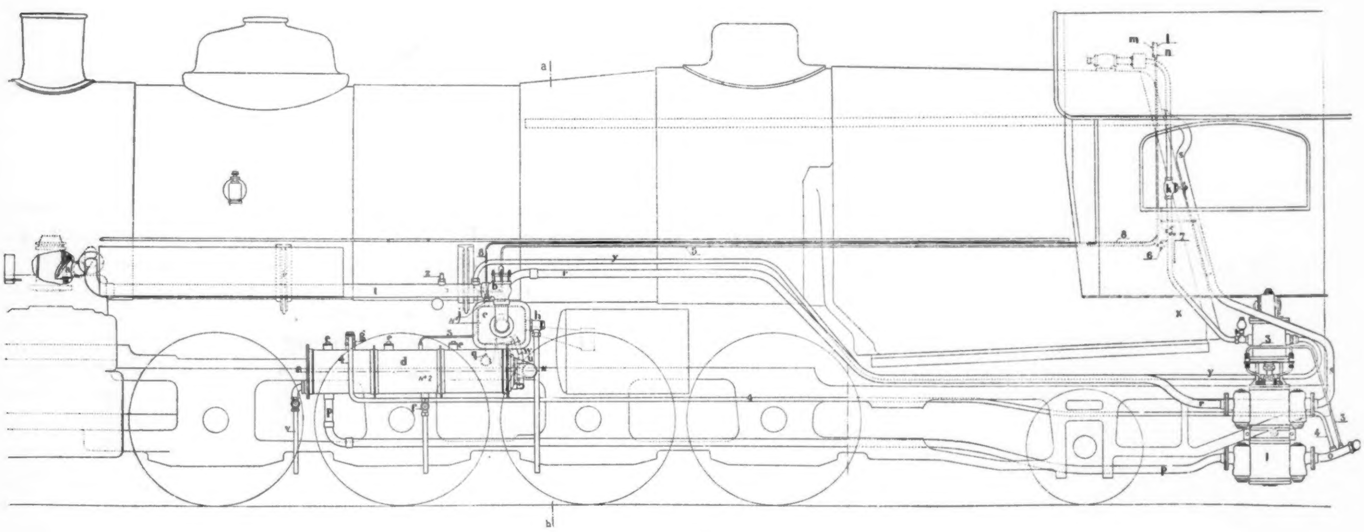


Fig. 3

This system eliminates injector boiler feeding, accomplishing this through means of a steam driven pump. The source of the pre-heat is exhaust from the cylinders and pumps.

A part of the exhaust from the cylinder is diverted from the nozzle by means of a shutter or flap valve controlled from the outside of the smoke-box, and is brought through the pipe *T* to the automatic regulating valve *B*, in connection with the exhaust from the pumps which is tapped in at *Y* and *Z* and introduced into the upper of the two heating tanks (1); thence through pipe *U* into the lower heating tank (2), the water surrounding the tubes in the tanks absorbing the heat from the steam, the condensation running out through pipe *V* to the ground.

Water enters the pump through the pipe *O* where it is forced through the lower or cold water cylinder, through pipe *P* into the lower heater No. 2—from there it flows through the pipe *Q* into the upper heater, thence through pipe *R* to the upper or hot water cylinder, thence through pipe *S* into the boiler.

Two cylinders are necessary for the pump, as the upper heater, No. 1, is higher than the water in the tank, so that it would otherwise be impossible to properly lift the heated water from the heater to the pump.

A safety valve set at 5 lb. is placed on tank No. 2 at *g*, and is connected to the pipe *O* on the tank side of the pump to avoid waste of water; *h* is a safety valve set at 15 lb. as a protection in case valve *g* should not work. Pipe *5* runs to the cab and is connected to a low pressure gage; pipe *8* runs to the cab and is connected with a pyrometer. The outlet pipe from the pump is also equipped with a pressure gage in the cab. With this device at gage pressure of 185 lb. and tank temperature of 60 deg. F. a delivery temperature of 200 to 210 deg. F. may possibly be attained, representing a saving of approximately 13.5 per cent, less the steam loss incident to operating the pump, and any loss from reduction of draft that might be occasioned by diminishing the volume of steam exhausted through the stack. In this connection it is claimed that not more than 6 to 8 per cent of the exhaust is utilized, the supply being automatically adjusted.

DISCUSSION

J. A. Carney, superintendent of shops of the Burlington, spoke of tests being made on that road with a duplex water pump, located on the side of the locomotive, for forcing the water into the boiler. The exhaust on both this pump and the air pump is used to heat the water in the tank. It has been found that an average of 177 deg. is obtained at the boiler. As high as 205 deg. has been reached and the minimum was 138 deg. With this arrangement it is claimed that 12½ per cent economy is obtained. Some members spoke of turning the exhaust steam from the pump into the tank when injectors are used, care being taken that the temperature of the tank water did not get so high but that the injectors could handle it. Other members have found that this was not satisfactory, as with some grades of water a deposit of scale would be found in the tank.

ENGINE FAILURES ON THE COTTON BELT

A paper by Raffe Emerson on Fuel and Failures was read. This is a study of some results on the St. Louis Southwestern. An abstract follows:

The St. Louis Southwestern, including the Texas division of the road, operates about 250 road locomotives. About 200 of these are in service, the others being spare and shop engines. This represents average present conditions. Thirty-

five switch engines are not included in these figures. Ten years ago there were about 50 engines less than now. The present mileage per year of road engines is about 6½ millions, a little over 4 million of which are in freight service. The yearly total locomotive mileage of road engines ten years ago was not much less than now.

The following is the failure record for 11 years:

Calendar year	Engine failures	Calendar year	Engine failures
1903	268	1909	95
1904	294	1910	106
1905	273	1911	160
1906	254	1912	145
1907	250	1913	101
1908	132		

It may be explained that the definition of an engine failure on the St. L. S. W. is about the same as for other roads in the same territory. Mr. Adams has succeeded in bringing his engines up from a performance of less than 10,000 miles per failure, to a yearly average of over 65,000 miles, and he has frequently reached as high as 200,000 and 300,000 miles between failures. One case is on record of 503,000 miles without a failure.

The Cotton Belt failure record owes its remarkable improvement chiefly to the following elements:

Elimination of the words "Poor Coal" as an engine failure excuse. Mr. Adams maintains that no coal is poor—that all kinds of coal may be successfully fired if the peculiarities are understood, and sufficient skill is used in handling the fire.

Attempt to eliminate all causes of mechanical failure, by redesigning and replacing every kind of locomotive part that breaks or fails.

A rigid system of inspection of the engine on arrival at a terminal. This rigid inspection is not costly; it is certain in its operation and results, and it pays.

Thorough understanding and co-operation between mechanical officers, shop men, roundhouse men and road men.

ECONOMIES IN ROUNDHOUSE AND TERMINAL FUEL CONSUMPTION

A paper on this subject was presented by F. W. Foltz, fuel supervisor, Missouri Pacific. An abstract will be published next month.

OTHER BUSINESS

A. L. Mohler, president of the Union Pacific, made a short address during the Tuesday morning session. He spoke of the manner in which some roads are improving the fuel situation consistent with their financial condition, calling attention to the possibilities there are in this connection for the saving of money, particularly where funds are available to invest in this direction. The fuel question should be carefully studied and studied properly, being followed through its course on the railroad from the purchasing agent, who buys it, to the engine crew and others who use it. To obtain the best results there must be the greatest harmony and co-operation between all departments which in any way effect the consumption of fuel. The water conditions must be good, which means heavy outlay, and the coal supply uniform. Care must be taken in train movements, and all correlated matters given thorough consideration. Mr. Mohler was thoroughly in sympathy with the work of the association.

H. L. Cole, assistant secretary of the government railway board of India, attended the meetings and made a brief address on conditions in India. He is making a tour of inspection of American railroads.

M. D. Franey, master mechanic, Lake Shore & Michigan Southern, made a few remarks on the new smoke washing plant at the Englewood roundhouse, mentioning the success with which the installation had been attended.

Mr. Perley, of the Oregon Short Line, addressed the members pointing out how they may greatly assist the railways in forming public opinion by mentioning to the people with whom they come in contact the real trials and tribulations of the railroads.

J. G. Crawford reported for the committee on fuel tests that very little information could be obtained, suggesting that the roads endeavor to obtain all the information possible as to the efficiency of the different grades of coal, methods of firing, etc.

The secretary's report showed a total membership of 642, with a cash balance of $885.25.

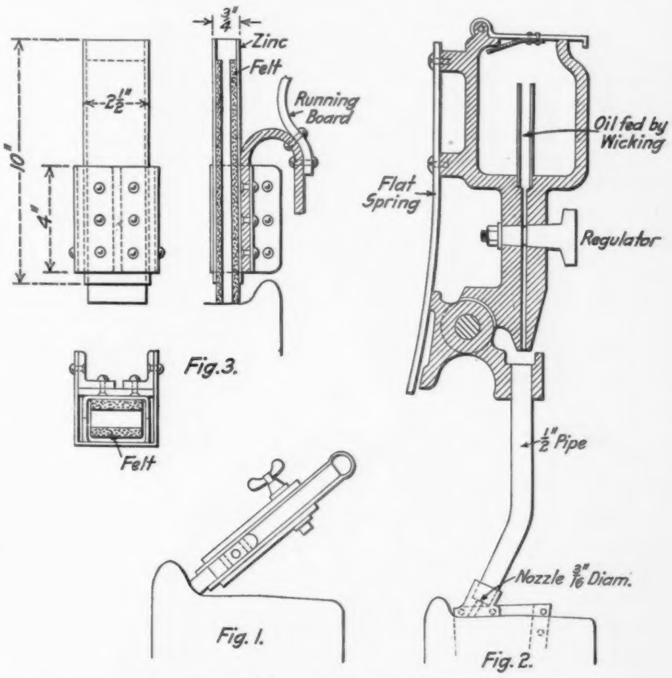
The following officers were elected for the ensuing year: D. R. MacBain, superintendent motive power, Lake Shore & Michigan Southern, president; D. C. Buell, Union Pacific; J. G. Crawford, Chicago, Burlington & Quincy, and B. P. Phillippe, Pennsylvania Railroad, vice-presidents. E. W. Pratt, Chicago & North Western; C. M. Butler, Atlantic Coast Line; W. L. Robinson, Baltimore & Ohio; T. J. Lowe, Canadian Northern; R. R. Hibben, Missouri, Kansas & Texas, were elected members of the executive committee. Chicago was chosen as the next place of meeting.

FLANGE LUBRICATORS

BY ROBERT W. ROGERS

There are many devices used in Europe to lubricate driving wheel flanges. The German Railway Administration Society recommends the use of flange lubricators on the forward driving wheels of all passenger locomotives and the rear wheels of locomotives having a tender as part of the locomotive. This class of engine is used in both freight and passenger service.

The lubricator cup is generally placed above the running board and the lubricator so attached that the vibration or the move-



Flange Oilers Used in Europe

ment of the driving springs cannot influence its position against flange. The well known hard grease type is met with quite often, the cartridge being filled with a grease and tarry compound. This is shown in Fig. 1.

Another type is shown in Fig. 2 which has the nozzle guided against the flange by a plate spring in conjunction with a movable arm. This type is fed by crude oil, the flow being controlled by a drip cock. Fig. 3 shows an apparatus used in Austria. In this case the cartridge consists of a sheet of plate zinc filled with felt. Where the valve stuffing boxes are high the oil and water from the swab cup is led to this lubricating cartridge.

RAILWAY STOREKEEPERS' ASSOCIATION

Outlines of the Papers and Discussion at the Eleventh Annual Convention Held at Washington, D. C.

The eleventh annual convention of the Railway Storekeepers' Association was held at the Hotel Raleigh, Washington, D. C., May 18, 19 and 20, J. W. Gerber, general storekeeper of the Southern Railway at Washington, presiding.

The convention was opened with prayer by the Right Reverend Alfred Harding, bishop of Washington, after which the association was welcomed to the city by Hon. Oliver P. Newman, commissioner of the District of Columbia.

THE PRESIDENT'S ADDRESS

President Gerber, in his opening address, spoke in part as follows:

The first two years of the life of this association can probably be best described as a period when we were finding ourselves. This is indicated by the papers discussed at that time. At the convention of 1907, President Rice, in his address to the association, stated that he believed that we have proven to our superior officers, each year, that we are benefited by coming together as an organized body.

What was true then is true today and each year of the life of the association has seen a broadening of the scope of its work, making possible more systematic and intelligent methods in the ordering and handling of material and supplies and an increasing effort on the part of the members to place the work of the stores department on the highest possible plane.

Through the work carried on by the members special interest has been created in the reclaiming of serviceable material from scrap, the elimination of obsolete material from stocks, better methods of accounting, and a realization of the responsibility that is ours in connection with the handling and care of the vast amount of material required in railway operation.

We have seen the adoption by the association of a standard classification of scrap, a standard material classification, standard specifications, classification and inspection rules for railroad construction oak timbers, these specifications having been accepted as recommended practice by the Master Car Builders' Association and Master Mechanics' Association, and adopted by the Hardwood Manufacturers Association of the United States.

While the adoption by the association of a standard scrap classification has reduced the work of the scrap classification committee, I believe that the committee could be profitably engaged in considering suggestions of changes in the classification to meet changing market conditions, and the collecting of information showing the advantages of a uniform classification for scrap material. The classification recommended by the association will not take the place of the various scrap classifications now in use by the railroads until we can show by specific examples that the Railway Storekeepers' classification does possess advantages over the other classifications. The subject is one which concerns every railroad and a great many of our manufacturing plants.

The committee on standard buildings and structures, appointed since our last convention, has already shown the necessity for such a committee, and the information gathered and placed at the service of the lines represented in the association is of great value. Through the work of this committee we can keep in touch with the latest and best designs in the construction of storehouses, oil houses, lumber sheds, casting platforms, scrap docks, etc.

The committee on the book of standard rules will present a report representing a vast amount of labor on the part of the committee members and providing in every detail for a complete stores department organization. No more important work has had the consideration of a committee of this association. I think we can safely predict that the value of the book of rules will be quickly recognized by all railways and that it will become the hand book and guide in the daily operations of stores departments.

The growth of the association has been very gratifying, and although counting an existence of only 11 years, we now have more than 215,000 miles of railways in the United States represented by membership in the association, the equipment of these lines totaling more than 57,000 locomotives and 2,400,000 cars.

A very large proportion of the railway mileage of the Dominion of Canada and the Republic of Mexico is represented in the association and we also have representatives of the railways of England, Australia, Japan, China, Cuba, Honduras, South and East Africa.

The active membership is over 700. Membership alone, however, is not our principal claim for the benefits arising from the Railway Storekeepers' Association. Rather it is the awakened interest in the daily work of the stores department employees, and the putting into effect of better methods resulting in greater efficiency and economy in railway operation, all of which is being accomplished by the bringing together in one association of representatives of the stores, purchasing and accounting departments.

FAIRFAX HARRISON'S ADDRESS

Fairfax Harrison, president of the Southern Railway, after a few opening remarks commending the association for the good work it was accomplishing, gave the following address on The Ideal Storehouse System:

No other business enterprise requires so many different things in such large quantities as a railroad, and the importance of the storekeeper in the railroad organization may be measured by the value of the materials and supplies for the safekeeping and proper issuance of which he is responsible.

The statistics of the Interstate Commerce Commission covering railroads having gross revenues of over $1,000,000 per annum, show that these companies, operating 239,938 miles, had on hand, on June 30, 1913, materials and supplies valued at $317,773,723, or an average of $1,324 per mile of road. Including materials and supplies carried by the Pullman Company, this total is brought up to something over $322,000,000. If we assume that these balances represent a three months' supply, this would mean that your monthly receipts and issues would aggregate something over $100,000,000 and that you handle during the course of the year property to the value of approximately $1,200,000,000.

For the successful and economical handling of property of this enormous value it is essential that your business shall be thoroughly systematized in all of its departments, and meetings such as this, where experiences can be compared and suggestions for improvements threshed out, are of practical value to the companies which you represent.

It is the duty of the storekeeper to have on hand and to supply promptly anything that may be required in the operation of the railroad he represents. But the storekeeper must also bear in mind that money tied up in material and supplies is unproductive capital. It is earning nothing while the articles for which it has been expended are lying in the storehouse. On the contrary, storehouse balances are a source of expense to the company in interest, taxes and insurance. The ideal system, therefore, is one which will result in the article wanted being always on hand while the accumulation of an excessive supply of any article is always avoided. I need not tell the members of this association that this presents a difficult problem. It is one,

however, that I believe is possible of solution. In my opinion the solution lies in effective team work, not only within the organization of the general storekeeper, but between his organization and all of the men of other departments to whom materials and supplies are issued. On every large railroad system there are liable to be accumulations of material at certain storehouses while others may be short of the same material, and the general storekeeper may often be able to keep down his total balances by transferring the surplus from a point where it is not needed to the storehouse needing it.

The men who use supplies can be most helpful in aiding the storekeeper to avoid the accumulation of excessive supplies of material in current use and in preventing the accumulation of obsolete stores. The natural disposition of everyone using material is in the direction of accumulating large supplies in order that his work may not be held up while waiting for some essential thing. He should, however, realize that it is to the interest of the company by which he is employed that an undue proportion of its capital shall not be tied up in storehouse supplies and he should loyally co-operate with the storekeeper to keep these down by carefully estimating his requirements.

It would seem that, under an ideal storehouse system, such a thing as the accumulation of obsolete stocks, except insofar as obsolete parts are salvaged from condemned equipment and structures, should be impossible. There is only one way in which it can be made impossible and that is through intelligent co-operation by the users of supplies. The storekeeper should be advised of any change of standard, not when it has actually been made, but as soon as it is in contemplation, in order that he may work off his stock and have a minimum amount of the old standard on hand when the new one is adopted.

I know that there is nothing particularly new in what I have said to you. Much the same ground has doubtless been gone over in former meetings of this association and improvements in practice have doubtless resulted. I think you will agree with me, however, that perfection has not yet been attained and that storekeepers, those who draw on them for materials and supplies, and the executives of the companies should all co-operate to bring about, as nearly as practicable, the ideal condition of having no surplus stock in any storehouse and of always having the thing that is wanted, when and where it is wanted.

REPORT OF THE SECRETARY-TREASURER

The report of the secretary-treasurer showed an active membership of over 700 and a balance on hand of about $700. A number of letters were read from railway presidents commending the work of the association.

ACCOUNTING

The accounting committee, consisting of E. E. McCracken (B. & L. E.), E. L. Fries (U. P.), P. J. Shaughnessy (Erie), H. H. Laughton (So. Pac.), W. E. Brady (A. T. & S. F.), D. A. Williams (B. & O.) and C. C. Dibble (C. C. C. & St. L.), gave a very complete and detailed report on the rules governing the accounting for material and supplies at storehouses. It was divided into four parts—Handling of Materials and Supplies, Accounting for Material Received, Accounting for Material Issued and Material on Hand.

Discussion.—A. A. Goodchild (Canadian Pacific) took exception to several points in the report, particularly those pertaining to cash discounts, and second-hand serviceable material.

A member of the committee stated in explanation that it was not the intention in the report to cover the practice in use on any particular road, but the report was given as the most desirable practice to be employed. The president explained that the report was not binding on any road. The report was adopted and referred to the Association of Railway Accounting Officers.

RECEPTION BY THE PRESIDENT

On Monday afternoon, May 18, members were driven to the White House, where they were received by the President of the United States.

STORE DEPARTMENT EXPENSES

E. L. Fries, auditor of disbursements, Union Pacific, presented a paper on this subject, giving an analysis of the methods which should be employed in distributing various charges to different accounts.

STANDARDIZATION OF TINWARE

The committee on the standardization of tinware reported that it is working in conjunction with a similar committee of the Master Mechanics' Association. The report is to be considered at the June convention of the latter association in Atlantic City, after which arrangements will be made for its presentation for the action of the Storekeepers' Association.

UNIFORM GRADING AND INSPECTION OF LUMBER

A majority and a minority committee report were submitted on this subject, the latter by W. H. Clifton, Baltimore & Ohio. In the discussion, several members approved the minority report, but many, while holding the belief that it was desirable as an ideal toward which to work, questioned its practicability. The minority report took the stand for inspection of all lumber at the point of shipment, and the differences of opinion hinged mainly on this. W. F. Jones (N. Y. C.) suggested the formation of a bureau for the inspection of lumber at the mills for all railways. This, it was claimed, would largely do away with the increased expense and the difficulty of keeping inspectors busy when inspection at the mills is carried out by the roads.

It was finally moved that the members of the committee get together and endeavor to arrive at an understanding. This was done and the amended majority report was adopted as recommended practice and referred to the American Railway Association. Following is the amended report:

The committee on uniform grading and inspection of lumber were requested by the executive committee, first, to make a recommendation as to whether material inspection should be done at destination or at the point of shipment, and second, to report on the uses of various woods in place of oak for stock and box cars.

The committee is unanimous on the following:

(1) That all piling and track ties should be inspected when received and loaded at shipping points.

(2) That all material which is termed direct shipments, that is, shipments for construction, whether it be bridge or building material should be inspected before loaded or rather at the shipping point, for the reason that it is seldom that there are practical men where the material is unloaded to inspect and receive it and if such is the case, inferior material is often accepted and used.

(3) Lumber which is shipped direct for any purpose ought to be inspected when loaded at the shipping point. To illustrate: The Missouri Pacific runs through a timber country. The probability is that 75 per cent. or more of its switch ties are loaded at the mills and shipped direct to the point where they are to be used. In such cases it is always practical and advisable to have the material inspected at the shipping point before loaded. The same holds true in the extreme Northwest.

[A paragraph was here inserted, replacing a list of the differences between the committee members and recommending the formation of a bureau for the joint inspection of lumber. It was also recommended that after lumber is once rejected, it be not accepted for any purpose.]

The committee reported on the second request that the Chicago, Milwaukee & St. Paul has been using Douglas fir in place of oak for the following purposes:

For Stock and Box Cars: Sub sills; nailing strips; eng. plates; carlines; cross ties; needle beams; side braces; end braces; ridge pieces; cornice side; belt rails, end and side; side door headers; side door cleats; end door cleats; stock car slats, side and end.

For Locomotives: Pilots and pilot slats; running boards; foot

boards and steps; cabs; bumper beams; longitudinal sills for tenders; foot boards; foot steps and coal gates for tenders.

Other roads in the Northwest and Canada have been using maple for draft timbers and find that it has given as good or better service than the average oak which they receive from the South.

STANDARD BOOK OF RULES

The report of the committee on the standard book of rules consisted of a set of rules comprising a book of 146 pages. This is intended as a foundation for building up a store department on new roads or reorganizing on roads which already have such a department. It is very complete and is a combination of and selection from the best methods now in use on many different railways. It is not intended that it should be binding on any road to adopt it, but the committee believes that with the necessary changes to suit local conditions it forms the best means of organizing an efficient store department. The book was discussed in sections and a number of slight changes suggested. It was finally approved and adopted.

PIECE WORK

The committee on piece work felt that there was but little to add to what has already been presented to the association in regard to the establishing and maintaining of the piece work or "unit" system of handling supplies and material in the store department. Data were, however, submitted in addition, relating to the best manner of establishing prices and to a comparison of day work and piece work costs taken from actual operations of different railroads.

The committee recommends a form to be known as form R. S. A. 200, as the best means of securing the necessary information on which to base piece work prices. This form should be placed in the hands of the storekeeper, or others in charge, so that whenever it is desired to make a new rate, or change an old rate where conditions have been changed, he may compile the data from actual operations. Before securing such data the storekeeper should study the operation carefully and make sure that there are neither too many nor too few men engaged in the work, and that the conditions are the best commensurate with such expenditure as the management will permit.

The data should then be obtained without the knowledge of the men doing the work in order that it will represent a normal day's work under normal conditions on a day rate basis. This is not done with any idea of being unfair to the men, but rather with the idea of being fair in all cases to both the company and the men. Should the men be aware of the fact that they were being watched and time observed on the operation which they were performing, it would be a very easy matter for them to regulate their speed so that the data would not be a true representation of a normal day's work, hence the price would be established on an unfair basis which would sooner or later prove unsatisfactory to the company or to the men. This is a condition that should by all means be avoided, hence the importance of securing data that do represent a normal day's work under normal conditions. As a further precaution this data should be secured by someone who is familiar with the material being handled, who understands men and knows how to handle them and what they should be able to accomplish under normal conditions in the handling of such material. There should be at least five operations observed on each schedule, and ten are better if time and opportunity will permit. It is not fair either to the company or to the men to establish a piece work price on one or two operations, for the reason that there is a liability of making a price either too high or too low. Too much care cannot be exercised therefore in establishing prices, for, while it is an easy matter, so far as the men are concerned, to increase a rate it is a very difficult matter to decrease one, without creating dissatisfaction, unless there has been a change in conditions.

The data to be obtained and entered under the different column headings should be as follows:

Date.—The date the operation is performed.

Number of Men.—The total number of men engaged in the operation.

Hours Each.—Total hours each man works on the operation.

Total Hours.—Total hours for all of the men.

Material—Quantity.—Quantity of material handled under the operation.

Material—Unit.—The unit under which the material is handled.

Hourly Rate.—Hourly rate paid the men on a day rate basis.

Remarks.—Any additional information.

Average Cost.—The average cost per unit as indicated by the totals for all of the operations.

The storekeeper will then recommend the price in the space provided. In all cases the storekeeper personally should make his own recommendations for piece work prices and in no case should this authority be delegated to another member of his organization.

There are two blank lines provided for a full description of the operation on which the price is desired. This description should not only outline the kind of material to be handled but should state the kind of car, distance carried, and all other conditions which affect the operation.

After the data have been secured, form R. S. A. 200 should be made up in triplicate, the original and duplicate being sent to the general piece work inspector for his approval or disapproval, and the triplicate retained by the storekeeper. In all cases approvals should be made by personal signature of the storekeeper to these requests for prices. If the prices recommended meet the approval of the general piece work inspector he should instruct the storekeeper to make up form R. S. A. 201 (which is a reconstruction of form A as shown on page 147 of the 1910 proceedings of the Railway Storekeepers' Association), in quadruplicate, sending the original and two copies to the general piece work inspector with the original and duplicate of the data sheet attached, retaining the fourth copy for his file. The general piece work inspector should then approve and forward all papers to the general storekeeper or other official for his approval. If, however, the price recommended by the storekeeper does not meet with the approval of the general piece work inspector he should investigate further before authorizing the issuing of R. S. A. 201 to cover.

As a further argument in favor of the piece work system of handling material the committee secured and presented with the report comparative data on a number of operations showing the cost per unit on a day rate basis as compared with the cost on a piece work basis. These data were furnished from actual operations and showed the saving which it is possible to effect under the piece work system from a financial standpoint.

DISCUSSION

The report was accepted and adopted as recommended practice. A rising vote showed that of those roads represented at the convention, the New York Central, Atlantic Coast Line, Philadelphia & Reading, Chicago, Indiana & Southern, Burlington, Toledo & Ohio Central, the St. Paul and several others use a piece work system in handling stores.

EFFICIENCY FROM STORE DEPARTMENT EMPLOYEES

Three papers were presented at the convention on the subject of How to Obtain the Greatest Efficiency from Employees in the Store Department. The following is taken from a paper by W. D. Stokes, general storekeeper, Central of Georgia:

Irrespective of the convenience, at times, of having it otherwise, the stern fact cannot be evaded that there is no period in any business career which may be correctly characterized as that of standing still. Progression or retrogression is invariably in process, no matter how imperceptible.

A generally accepted precedent in the organization and conduction of affairs, military, civic and commercial, is that the per-

sonality of the leader enters largely into their success and it would, therefore, appear as a logical sequence, that one of the fundamentals in obtaining efficiency in any undertaking is a careful consideration of the requirements of the person to be selected to act in the capacity of executive.

Organization is largely a matter of instinct, experience and common sense in the selection of subordinates who are capable of fulfilling the requirements, judgment frequently of necessity being deferred, and the systematic assembling of forces in accordance with a definite plan as to what is necessary to conform to the contemplated system.

The diversity of opinion as to detail of the type of organization best adapted to requirements is so great, and the results as obtained from diametrically opposite arrangements are so uniformly satisfactory, that it would appear that this subject has nothing in common therewith and that the principal point at issue is how best to regulate and inspire to bring about an economical and satisfactory conservation of the material and supply investment, and distribution and accounting for it, without embarrassment to operation.

However, no matter how carefully the organization is planned failure to observe certain injunctions will cause the work to go for naught.

It is impossible to successfully lay down hard and fast rules for the entire government of any body of employees, local conditions and temperament, if no other reasons, making this prohibitive and, while it is conceded that discipline is an absolute essential, other important adjuncts should be brought into play. Uncontrollable temperament has no place in the daily walk of successful business life.

Inspire by precept, example, fair play and personal interest that confidence essential to efficiency, without which no organization can hope to succeed, and the encouragement resultant therefrom will bring a loyalty and willingness which cannot but be productive of results. As you regard your subordinates, so you may expect others to do. Disparagement by inference, or otherwise, exerts a contaminating influence difficult to overcome. Disloyalty or indifference may be quickly bred by such tactics and the most carefully built up organization disrupted. Forbearance therefore should be cultivated.

Application is worthy of a prominent place in the consideration of this subject, as without this sterling quality there is little hope for success, either upon the part of the executive or the organization. The misguided idea that affairs are in such shape as to automatically conduct themselves or, at worst, require supervision of only a superficial character, is a fallacy which has frequently caused otherwise perfectly capable men to wonder why some of their fellows were getting the promotions. It can safely be said that the only thing a department will do automatically, is go to pieces.

The following is taken from a paper on the same subject by F. R. Brown, Oregon-Washington Railroad & Navigation Company:

Supplementing this subject let us consider when the greatest efficiency has been obtained from employees of the store department.

The store department has attained a high degree of efficiency—

(1) When it has, by careful calculation and the exercise of good judgment, anticipated the regular requirements of its customer, the railroad, and stands ready to deliver the goods on demand.

(2) When the stock carried is a minimum.

(3) When purchases or other sources of replenishment are a minimum. This is interlocked with the subject of paragraph (2), but it goes deeper, because a large percentage of purchases does not affect the storekeeper's books.

(4) When the investment of the railroad's funds in material is wisely proportioned to the demand therefor.

(5) When material received is of the grade or quality specified in the purchase order, whether covered by written specifications or not.

(6) When requisitions are intelligently questioned, when necessary, intelligently filled and as nearly as possible to the time of actual use; also when the material furnished is that which is best adapted to the purpose or circumstances, and not higher in grade, and therefore in cost, than is actually necessary.

(7) When deliveries or shipments of material are followed up to see that salvage is given into the custody of the store department and that such salvage is most economically disposed of. In order to secure best results in this, I believe that requisitions should be printed with a detachable numbered salvage coupon so that where salvage cannot accompany the requisition for new material, the coupon can be detached and held until such time as the salvage does come to hand.

(8) When scrap piles have been searched for the recovery of all salvable material.

(9) When attention is called to instances of misuse or abuse of the company's material when observed, even though it has passed from the custody of the store department.

(10) When the actual cost of handling stores is a minimum.

(11) When the difference between value of actual stock on hand and book value, as disclosed by the annual inventory, are a minimum.

(12) When conservation of lumber and other material is practiced to the extent of securing the highest possible class of service from it at every stage, from new to what is frequently miscalled scrap.

This list could be doubled without reaching the limits of the store department's possibilities. The adoption of these twelve principles, and the addition to them of any others that suggest themselves is recommended; also that they be printed and a copy furnished to each employee.

This subject was also dealt with by E. J. Roth, general storekeeper, Chicago, Indianapolis & Louisville. He said in part:

From the many definitions of an efficient store department, I would select the following: An efficient store department is one which is so organized and operated as to be able to promptly supply the proper material to be used by employees in any other department of the service, with the minimum cost to the company, considering not only the physical handling and the actual accounting for the material, but the interest on the money invested in the material itself, in the buildings and yards for its proper storage and appliances for its economical handling, together with the loss due to depreciation in material and facilities, necessary insurance, and all incidental expenses.

I can conceive of a store department organization which would be far from efficient in the sense of this definition, although composed of many individuals efficient in so far as that they properly performed the duties assigned to them by the persons under whom they worked.

The individual efficiency of its employees is of value to a railroad company only in so far as it increases the earnings, or decreases the expenses of that company, and the team work obtained through proper organization with clearly defined duties and responsibilities for its various members and providing for proper supervision must be secured if real efficiency is to be had.

The proper arrangement of material in store houses and yards, from the standpoint of accessibility, including the systematic grouping of material of the same general kind in a definite order, is essential.

A most important factor is uniformity. When applied to a store department, this is a very broad term. The most economical and otherwise satisfactory manner of ordering and receiving material should be determined and this method essentially followed at all store houses and material yards.

Employees of a department, the methods of which are uniform at all points, can be transferred from one store to another, and take up the work of the new position effectively at once

without loss of time in teaching them the methods in use at their new location.

Efficiency from unskilled laborers employed in the physical handling of heavy materials in considerable quantities can be secured by a proper piece work system for payment of the men. I do not wish to be misunderstood in this. Piece work is not a panacea for all of the ills besetting a storekeeper; in a wareroom where small quantities of many different kinds of material are handled it is of doubtful value, to say the least.

The securing of individual efficiency from unskilled laborers is simple in comparison with the difficulties encountered in securing efficiency from the more important members of the store department organization, the wareroom men, the stockmen, clerks, foremen and storekeepers. These men constitute the backbone of the organization. By the results of their efforts the department will, in a great measure, be judged. The men to fill these positions should be selected with great care. To aid in their selection and education, for the particular work for which each shows particular fitness, an apprentice system carefully planned and even more carefully followed up should be of material assistance.

Not many years ago, it was possible to obtain from our laborers' ranks, men who could competently fill the positions of foremen, and could, in many cases, continue on up to the top of the organization. Needless to say, few if any of the foreign laborers we must use in most localities today are capable of this. We cannot get young men of the proper caliber to eventually fill executive positions, to work on the same basis as these foreigners. We must make them see that they will receive special education and attention, and reasonable advancement. A proper apprentice system provides such inducements.

OTHER REPORTS

S. C. Pettit, stationer, Grand Trunk Pacific, read a paper on the Handling of Stationery. The Committee on Recommended Practices presented a brief progress report. The Committee on Scrap Classification was not in position to report at this convention. J. G. Stuart (Burlington) explained a loose leaf stock book used on that road which is printed to obtain uniformity in naming parts and avoid copying each month. The Committee on Standard Buildings and Structures showed a number of photographs with dimensions and data regarding storehouses, making possible a choice to suit conditions in establishing a new storehouse. The Committee on Marking Couplers had no definite report and was continued.

OTHER BUSINESS

On Tuesday, May 19, the ladies were taken in auto buses during the morning to visit the principal points of interest in Washington, and in the afternoon all those in attendance at the convention were taken by boat to visit Mount Vernon and Marshall Hall, Md., where a Potomac river supper was served. This trip was under the auspices of the Chamber of Commerce of Washington.

ELECTION OF OFFICERS

The following officers were elected: President, G. G. Allen, Chicago, Milwaukee & St. Paul; first vice-president, H. C. Pearce, Seaboard Air Line; second vice-president, J. G. Stuart, Burlington.

The Railway Materials Association elected C. B. Yardley, Jr., president, and J. Parker Gowing, secretary-treasurer.

ELECTRIFICATION OF GERMAN LINES.—In order to relieve the congestion at the large main station in Hamburg, Germany, a proposal is to be embodied in the next Prussian railway budget for the electrification on the Hamburg-Altona-Blankenese single-phase system of the suburban line to Bergedorf and Friedrichsruhe. The work is likely to be completed in two or three years, and will form an extension of the lines already electrified.—*The Engineer.*

PERFORMANCE OF FRENCH PACIFIC TYPE LOCOMOTIVES

The following statement regarding the work done by superheater compound Pacific type locomotives on the Paris, Lyons & Mediterranean is made by M. Maréchal, the locomotive engineer of that road: It is true that on the fastest trains, such as the "Côte d' Azur Rapide" and the "Calais-Mediterranean Express," our Pacific engines are underloaded, but that is done with the intention to allow these engines to easily make up time when the train is late. This consideration is very important on such long runs as from Paris to Vintimille; on such a run (700 miles long) there is always the possibility of having some block signals against you for slow orders on account of maintenance of way, or for a delayed freight train, the side-tracking of which was not completed on time, and so on. This is still more necessary when you consider the Calais-Mediterranean express may be delayed on account of the late arrival of the boat at Calais when the weather is bad in the Channel. When these trains are late, the work of our Pacific engines is often very interesting, in spite of their light loads. I give you two instances of such work, one for the Côte d' Azur and the other for the Calais-Mediterranean. Train No. 16 (the return Côte d' Azur Rapide), weighing only 274 (metric) tons, was delayed at Lyon 20 min., but arrived on time at Dijon, the engine, a four-cylinder simple Pacific with superheater, making up 6 min. between Lyon and Mâcon, and 14 min. from Mâcon to Dijon, in spite of a regulation slow down to 25 m. p. h. at Chalon. The run from Lyon to Dijon, 122 miles long, was accomplished in exactly 2 hours, including a 3-min. stop at Mâcon, and the slow down at Chalon. Deducting the stop at Mâcon, but including the slow down at Chalon, gives an average speed of 62.5 m. p. h. for the whole 122 miles run; the continuous speed never fell below 65 m. p. h. on stretches of 22 miles between Lyon and Mâcon, 29 miles between Mâcon and Chalon, 31 miles between Chalon and Dijon; a speed of 68 m. p. h. was sustained on continuous stretches of 11 miles between Mâcon and Chalon, and 13 miles between Chalon and Dijon; the maximum speed attained was 74.5 m. p. h.

Train No. 21 (the down Calais-Mediterranean), weighing 356 (metric) tons, made up 20 min. from Dijon to Lyon, with a four-cylinder compound Pacific locomotive with superheater; 10 min. were picked up from Dijon to Mâcon, in spite of the slow down to 25 m. p. h. at Chalon already referred to, and 10 min. also from Mâcon to Lyon. Deducting the 3-min. stop at Mâcon, but including the slow down at Chalon, the whole 122 miles run from Dijon to Lyon was made in 1 hour 56 min., which gives an average speed of 63 m. p. h., the continuous speed not falling below 65 m. p. h. on stretches of 34 miles between Dijon and Chalon; on 24 miles between Mâcon and Lyon a speed of 68 m. p. h. was sustained; on continuous stretches of 24 miles between Dijon and Chalon, of 13 miles between Chalon and Mâcon, and of 8 miles between Mâcon and Lyon, the maximum speed attained was 74 m. p. h. (the limit allowed by law is 74.5 m. p. h.).

With these "extra rapid" trains, the loads rarely exceed 350 tons, the limit being provisionally fixed at 370 tons for four-cylinder simple Pacific type engines with superheater, and 170 lb. boiler pressure, and at 400 tons for four-cylinder simple Pacific type engines with superheater and 200 lb. boiler pressure, or for four-cylinder compound Pacific type engines with superheater and 227 lb. boiler pressure. For "rapides" or express trains with somewhat slower schedules, regular loads of from 400 to 450 tons are fixed; but overloading is not uncommon on holidays or in the case of the boat trains from Marseilles.

A RAILWAY FOR ICELAND.—Hitherto the people of Iceland have used the local ponies as their means of transport, but now a railway is to be built from Reykjavik to the Rangarvalla district, the distance being about 60 miles.

CAR DEPARTMENT

HOT BOXES*

BY O. J. PARKS

General Car Inspector, Northwest System, Pennsylvania Lines West of Pittsburgh

Of the various defects common to car equipment, hot boxes represent the greatest detention to car and train movement. The heating of one journal not only delays the particular car en route, but is often the cause of serious detention to other trains. In addition to these delays it is frequently necessary to switch the car to the shop for the repairs, at a switching cost varying from one to ten dollars, to which should be added the repair cost. It has been stated that the total average cost of the switching and repairs is about $10 per hot box, without taking into consideration the heavy expense of wrecks due to this cause, consequent delay to traffic, etc. The principal items of the repair cost are renewal of bearing and sponging one or more times, and frequently the removal of the axle for journal truing or renewal, as may be required, which also calls for renewal of both journal bearings and quite often the renewal of journal box bolts. Further, when the wheels are stripped from the axle, many of them are condemned on account of the shop limits for remounting wheels, whereas, if the hot box had not occasioned their removal, they would have continued in service for perhaps six months or a year longer, because of the road limits being less severe than the shop remounting limits.

The following is a record of hot boxes on freight cars on the Northwest System for the last six months of the year 1912 and the corresponding period of 1913:

	1912		1913	
Month	Total hot boxes	Average per 100,000 car miles	Total hot boxes	Average per 100,000 car miles
July	2,583	7.72	2,251	6.33
August	2,542	7.36	2,161	6.14
September	2,789	8.98	1,860	5.82
October	3,027	9.14	1,739	5.26
November	3,519	10.74	1,504	4.85
December	3,583	11.40	1,541	5.55
Total	18,043	9.19	11,056	5.69

The above figures represent the total number of hot boxes, whether or not they caused detentions.

It will be noted that we had a marked decrease in the number of hot boxes for the six months' period of 1913 as compared with the 1912 period. If the average cost of $10 per hot box is correct, the total number of hot boxes for the six months' period of 1912 would amount to $180,430, while the total number for the 1913 period would represent a cost of $110,560, a difference of $69,870 in favor of the 1913 results.

In the early part of 1913 we started a special campaign against the hot box situation along certain lines, first, to ascertain the originating point of each car developing a hot box, then determine the cause and best way to bring about an improvement. In order to get at the source of the trouble we had our inspectors specify, on their daily hot box reports, the originating point of each car giving trouble, and with this information at hand a traveling inspector was sent to the points from which we were receiving an excessive number of hot boxes, to investigate the conditions and make recommendations for improvement. In addition, we compiled the hot box reports, in statement form, covering five-day periods, showing dates, car initials and numbers, and originating points, these statements being forwarded to the master mechanic of the division on which the cars originated. This information indicates to him the trouble he is sending to the other fellow. This plan has proven very satisfactory in arriving promptly at the responsibility by location, and entails but about 12 hours' labor of one clerk to compile the statements for one month.

The following are the principal causes for journal heating:

(1) The shifting of the sponging toward the outer end of the journal box, due to the lateral movement of the box. When the car is in motion, the end of the axle tends to draw the sponging away from the rear of the journal. An examination of the bearings and axles removed on account of hot boxes will show that heating, in the majority of cases, originated at the rear of the journal.

(2) Sponging too tight, due to an excessive amount of waste, in which case there is usually an insufficient amount of oil, the oil being forced out through the dust guard opening, and in consequence of the dry sponging, the journal is wiped dry of lubrication. In brief, when a box is tightly packed there is no space for the oil. Another feature is that the tight sponging, although not excessive in amount, but jammed between the journal and the side wall of the box, acts as a wiper, preventing the oil reaching the bearing, and not infrequently, strands of waste are drawn under the bearing, causing journal heating.

(3) Sponging glazed, due to dust, etc., and its not being agitated or set up with the packing knife frequently enough, this condition preventing the oil reaching the journal.

(4) Sponging wound in balls, or applied in bulk under the journal with separate portions along each side, there being no thread connections. The top portion acts as a wiper, thus preventing a sufficient amount of oil reaching the bearing.

(5) Insufficient amount of oil in the sponging, caused by it being siphoned away by loose strands of waste hanging out of the box, particularly in warm weather; also, in cold weather, water from snow getting into the box. The water being heavier will lift the oil, allowing it to escape from the box.

(6) Excessive amount of oil, which means an insufficient amount of waste. The sponging as a whole in this case falls away from the journal and the oil, being in excess, is thrown from the box by the revolving journal, or escapes through the dust guard opening, leaving the journal without lubrication, the dust guard opening being below the under side of the journal.

(7) Worn out sponging, short fibre, commonly called "muck" or "mush." This condition gives practically the same results as sponging with an excessive amount of oil, the tendency being for it to settle below the under side of the journal.

These are the most prominent conditions leading to hot box trouble; however, there are many other conditions of less frequent occurrence.

Aside from unavoidable conditions such as floods, etc., there is no occasion for an epidemic of hot boxes. My experience has been that an epidemic usually follows the "let-well-enough-alone" practice, and when the epidemic arrives everybody gets busy and by concerted action the boxes are put in shape, which, however, requires considerable time; then when the conditions become normal the let-well-enough-alone rule is resumed until the epidemic returns again, which may occur two or three times a year. There is no question, but that this system is wrong in principle and that far better results can be accomplished by constant attention to the boxes, and with the same force.

The average man engaged in this line of work is thoroughly

*From a paper presented at the May meeting of the Car Foremen's Association of Chicago.

familiar with the common causes of journal heating, and understands the proper method of packing and caring for journal boxes, and I do not hesitate to say that if he will exercise careful diligence and each fellow do his share, the hot box problem will be practically solved. Further, we should not lose sight of the opportunity for taking care of this detail of the car when it is on the repair tracks for repairs of any nature. Statistics show that there are about two and one-third million freight cars in the country, and, on the average, they are shopped about 12 times per year. If thorough attention were given all of the boxes each time the car is on the repair track, it would not be necessary to use so much oil and sponging while the car is in service.

I am a strong advocate of the use of prepared sponging, together with the proper use of the knife and hook, instead of the indiscriminate use of the oil can. However, I appreciate that the oil can may in some instances be used to advantage where the sponging is in proper position and in good condition, but lacking oil. On the other hand, if the oil can is indiscriminately used, the sponging, when not in good condition or not in its proper position, will ordinarily be overlooked, and the introduction of a little oil does not give the results. A few years ago it was the ambition of the average car oiler to use as much oil as possible, as he thought his services were measured by the amount of oil he used, and the result was that a large amount of the oil which was poured into the front of the box escaped to the ground through the dust guard opening in the back.

We have found that the best results are obtained by the use of a packing knife having an effective fish-tail point, in setting the sponging back in its proper position. This should be done promptly on arrival of the car at an inspection point, while the sponging is still flexible from the normal running heat, this prompt attention being particularly advantageous in the winter months. It is also desirable during the warmer months, as other defects can be detected at this time and promptly repaired, thereby avoiding unnecessary delay in the departure yards.

Another feature to which I would refer is the practice followed by some of the roads in marking with chalk, or otherwise, the date of journal box attention, with the understanding that where these dates are within 10, 20 or perhaps 30 days, the box lids need not be raised unless there are external indications of trouble. This practice is entirely wrong. At points where oilers are maintained, all box lids should be raised and if the oiler is competent he can discern at a glance what attention, if any, is necessary. On the other hand, however, I consider that the dating or marking of journal box attention is a good practice in that it affords the local foreman a ready means of check against the work of the oilers. In conclusion, I would say that the most important requirement for control of the hot box situation is eternal vigilance —look out for the back of the box.

DISCUSSION

F. C. Schultz contended that the lack of proper attention in the application of wheels is the cause of a great many hot boxes. When they are applied it should be seen that the journals are in perfect condition, and that the brass properly fits them. The most effective way of lubricating a car is with the saturated waste, instead of putting on lubrication over the old waste, and when this is done there should be sufficient help at terminals to have all boxes properly packed.

A. LaMar, Pennsylvania Lines West, said: The Pennsylvania uses a standard form on which is shown the date of the hot box, the point where the car was loaded and the name of the inspector. It shows the initial and number of the car, train number, whether the journal was packed or not, whether the packing was dry, sandy or otherwise, and the condition of the journal. These forms are sent to the office of the superintendent of motive power, who in turn forwards them to the man packing that car, giving him an opportunity to correct his weak points. About a year and a half ago these reports showed that 65 to 75 per cent of the hot boxes were due to cut journals. In packing the box it should be thoroughly packed inside of the collar and worked forward, and then in front of the journal provide a sponge of waste that has no connection with the waste underneath the journal, so that it will not have a tendency to pull the waste that is underneath to the outside of the box.

We have found by inspection that on about 90 per cent of the cars the packing has worked away from the back of the box. On a freight repair track or in a shop it is important to see that the journals are in perfect condition before they are placed under the car. There have been cases where leaded and even rusty journals have been placed under a car with no pretense being made of cleaning them off. The practice of the Pennsylvania when storing wheels is to use a sediment of oil that is very thick for preventing the journals rusting.

Geo. Thompson, Lake Shore, said: All of the cars on the Lake Shore are packed twice a year, and prepared packing is used instead of free oil. In the confusion in terminal yards it has been found that the oilers are very liable to hurry through their work and thus not do a good job on a journal. We constantly instruct them to take the time necessary to do a good job even if the train is delayed in the yards, as it is better to have it delayed there than on the road. The dates the boxes are repacked are stenciled on the end of the truck timbers. When we started the periodical packing I was very much opposed to it, but after we had gone ahead with it for some time I could not help agreeing that it was a good thing. In the packing which we take from these journals every six months a great deal of babbitt, dirt, sand, etc., are found. The brand new packing is no doubt a very good thing, and costs but little, except for labor. We do not throw the old packing away. After it has drained we shake it up, pick the good stuff out and renovate it with hot oil. We boil the oil out of it, then it is mixed and made ready for repacking.

C. F. Laughlin, Armour Car Lines: We adopted the practice of periodical packing about four years ago, and have largely eliminated the hot box. Not only that; we have accumulated waste, as there is always more taken out of the boxes than is required to properly repack them. Packing boxes too tight seems to be one of the greatest troubles we have. In general, I think the oilers put too much packing in. It also seems to me that it would be a good time to compel the manufacturers to have the name of the box put on the box as well as on the lid; then when the lids are missing we could probably find one to fit the box without much trouble, thus eliminating hot boxes from this cause.

O. J. Parks: In the past six months I have handled perhaps 4,000 reports of wheels removed because of cut journals. Ninety-two per cent of these wheels were removed on account of the journal being cut at the inside end. It is that part that should be given the most careful consideration. The packing for journal boxes should be made up of strands of lengths about equal to one-half the circumference of the journal, and when packing the box this sponging should be distributed equally under the journal and up to within ¾ in. of the center line. The waste should be carefully picked apart so as to prevent its insertion in balls.

Clyde Shipbuilding.—The output of the Clyde shipbuilding yards during the month of March totalled 27,400 tons, spread over thirteen vessels. This compares with 49,000 tons in the preceding month, and 61,000 tons in the corresponding month of last year, and is the smallest March total recorded since 1909.—*The Engineer.*

AIR BRAKE ASSOCIATION CONVENTION

Papers on Use of the Caboose Air Gage, Electro-Pneumatic Signal System and Modern Train Building

The twenty-first annual convention of the Air Brake Association was held in Detroit, Mich., May 5 to 8, W. J. Hatch of the Canadian Pacific presiding. The convention was opened with a prayer by the Reverend Chester B. Emmerson, and the association was welcomed to the city by Mayor Oscar D. Marx, of Detroit.

PRESIDENT'S ADDRESS

President Hatch took the opportunity of paying special tribute to George Westinghouse, the inventor of the air brake, who died during the past year, calling the attention of the members to the wonderful genius of the man, and the vast work he has done for his fellow men in the shape of his many inventions, of which the air brake will be his everlasting monument. Attention was called to the need for some means of adjusting the brakes on freight cars. It was believed that by having better regulation in this respect, many of the brake failures would be eliminated and a more evenly operated train would be obtained. If it were found too expensive to put on the automatic adjustment, provision should be made for manual operation. In speaking on the air hose question, he stated that the roads in the very cold climates had not yet obtained a hose that was giving entirely good results in the very cold weather.

The president expressed his optimism as regards the increase of business in the near future, calling attention to the vast amount of traffic handled by American roads. He cautioned the members to take advantage of the dull period by getting their equipment into shape for the rush season in the early fall. In regard to the terminal inspection of the air brakes in trains, he laid particular stress on the success attained by the system followed by the Santa Fe.

H. H. Vaughan, assistant to vice-president, Canadian Pacific, followed President Hatch's address with a few extemporaneous remarks. He spoke of the growth of the air brake, recalling experiences he had had in England with the vacuum brake. He believed that the electrically operated brake would solve many of the air brake troubles of the present time. Mr. Vaughan expressed an appreciation of the work the association has done for the railroads in general, and believed that this association had great opportunities ahead of it.

W. A. Garrett, chief executive officer of the Pere Marquette, followed Mr. Vaughan with some very interesting remarks on the relation of the public to railways, laying particular stress on the present condition of all roads in general, and clearly pointing out that the success of the railroads is a public one, in which the public should be interested and should give all assistance possible. It must never be forgotten that the railroad is a public servant in fact as well as in name, but the service which the railroad can give must depend on the treatment which it receives from its master.

THE CABOOSE AIR GAGE AND CONDUCTOR'S VALVE

Mark Purcell, Northern Pacific, presented a paper on this subject, an abstract of which follows:

On trains controlled by air brakes, one of the chief essentials is to know that the brake pipe is properly coupled up and charged the entire length of the train, and that the pressure is under full control by the engineer. This points directly to the importance of having all cabooses equipped with reliable air gages, so the trainmen, when in the caboose, may at all times know the amount of pressure in the brake pipe, and have a means of noting the variations when brakes are applied and released, and from this, together with the knowledge gained from the car-to-car inspections made in the standing tests required by the rules, be enabled to make a close approximation of the efficiency of the brakes.

The rate of rise in pressure at the rear end of the train when charging up after the brake pipe has been cut for any cause and recoupled, and when releasing brakes after ordinary applications, failure to maintain brake pipe pressure without variation while brakes are not being operated, any considerable decrease in pressure while en route without a corresponding effect of the brakes being felt, etc., are conditions that may be promptly noted; and from the fact that they indicate danger from sliding or overheating wheels, or from the engineer not being able to properly operate the brakes throughout the entire length of the train, the trainmen are warned in time so that measures can be taken to prevent serious consequences. In fact the caboose gage places the men at the rear end of the train on an equal footing with the engineer as to knowledge of what is taking place in the air brake system. This is not only desirable, but necessary, for safe and economical operation. There are many cheap gages on the market, but they seldom render satisfactory service, and the added first cost to procure a reliable article is fully justified by the longer and better service secured.

Provision should be made on all cabooses for easily and quickly applying brakes at times when impending danger to life or property makes it necessary to apply them from the rear, on account of the inability to make known to the engineer the need of a prompt application. The most important features in connection with this are that the valve be of sufficient capacity to cause quick action, and that it be located in an accessible place.

This valve should have the emergency feature only as providing the service application feature would quite naturally be looked upon by trainmen as an endorsement of the practice of making stops by applying brakes from the rear to avoid the inconvenience of transmitting signals to the engineer, and having the application made by means of the brake valve on the engine. It should be pointed out that, the fact of damage to equipment invariably resulting from the promiscuous use of the conductor's valve, does not permit of any excuse for using it in any other than cases of emergency.

It is our opinion that the best practical device for this purpose is a valve that can be opened quickly, and will provide a sufficient opening to insure quick action of the brakes the entire length of the train, or can be opened gradually, and a small amount, to produce a slow reduction to cause a service application, in cases of an immediate stop being necessary, and yet sufficient time available to permit of exercising care to avoid quick action of the brakes, which might, and often does, cause serious damage to the train, particularly when the quick action starts from the rear. When it is found necessary to open the conductor's valve to apply brakes on a freight train, it should be left open until the train stops.

DISCUSSION

The only objections presented against the use of the gage and conductor's valve in the caboose were that the trainmen would become too confident and remain in the caboose when they should be on the train; also that of the danger arising from applying the brakes in emergency from the rear end of the train. These objections, however, were overruled by other members of the association who had found this equipment to be valuable and satisfactory. Numerous cases were mentioned where serious accidents have been prevented. T. W. Dow, of the Erie Railroad, stated that on his road two runaways had been averted which, it had been estimated, saved enough money in damages to pay for the installation on every caboose on the Erie Railroad. It was not doubted but that the conductor's valve would sometimes be used for other than the purpose it was installed for, but it

was pointed out that if the trainmen were made to see the disastrous results that might accrue from this indiscriminate usage, this practice would soon be stopped. Several members spoke of the inaccuracy of the gages used on some of their cabooses, and believed that they had much better not be installed if they were not of standard and reliable makes, for an incorrect reading might lead to disastrous results. They should be tested as often as the air gages are tested on an engine.

By having the conductor's valve graduated it would be possible to make a service stop where an emergency stop is not necessary. The conductor's valve is specially valuable in backing into sidings, particularly in foggy weather. The gage gives the conductor or flagman at the rear of a long freight train a good opportunity to see just what pressure he has at the rear of the train before starting his train. Many engineers spoke in favor of the conductor's valve, even though they had had experience with their being mishandled. They felt safer with this protection on the rear end of the train. Mr. Langan, of the Lackawanna, believed it was one of the best safety devices that could be placed on a train. The Canadian Board of Railway Commissioners require the caboose gage on all cabooses operating in Canada.

FOUNDATION BRAKE GEAR

T. L. Burton, Westinghouse Air Brake Company, opened the discussion on this subject. He spoke of the success that had been obtained with the clasp brake, but at the same time laying particular stress on the fact that it must be applied correctly, for otherwise it would lose its efficiency. In some cases where care had not been given, it had been found that the clasp brake was not as efficient as the single shoe brake. In this respect he mentioned the fact that in applying any foundation gear a careful study must first be made. There can be no standard design for all cars, as the angularity of the rods has a great deal to do with the efficiency of the brakes. Also, the foundation gear should be made to operate as freely as possible, with no binding on any other part of the car.

C. W. Martin, of the Pennsylvania, stated that he had materially increased the efficiency of the foundation gear by eliminating binding in the rods. The gear should be designed to give an equal distribution to all shoes, and also to have the braking power remain the same as the shoes become worn. He had had particularly good success in case hardening the bearings to prevent wear of the parts. The piston travel should always be the same for different conditions, and the shoes should be placed accurately on the tread of the wheel so they will not force the journal out of the brass when the brakes are applied. In speaking of the clasp brake he recommended it for safety and maximum efficiency with the minimum pressure. P. J. Langan, of the Lackawanna, stated that he had, by stiffening the foundation brake gear, decreased the length of stops from 200 to 300 ft.

ELECTRO-PNEUMATIC SIGNAL SYSTEM

L. N. Armstrong, Pennsylvania Railroad, presented a paper on this subject, an abstract of which follows:

The present standard pneumatic train air signal used on steam trains has its limitations, and its operation on long trains is far from satisfactory. Where large volumes of air are used the signal valve has to be delicately adjusted; considerable time must elapse from the time the cord is pulled until the signal reaches the locomotive; several seconds must be allowed for the wave action of the air to subside and the line to recharge before another signal can be transmitted; false signals are given, caused by leaks in the signal line, even if the signal line is tight at the beginning of the run, as the long cars now in use when going over crossovers swing far enough to cause leaks at the signal hose couplings. These troubles have been overcome by using electricity as an agent to transmit the signal from the cars to the locomotive.

The signal switch, to which the ordinary bell cord is attached, has two wire connections, one for supplying the current to the switch, and the other for conveying the current to the magnetic valve in the cab.

The magnet valve consists of an electro-magnet, which, when energized, unseats a small air valve, allowing main reservoir pressure to flow directly to the whistle. A small spring closes the air valve when the current is off.

The whistle has an adjustable bowl, and is the same as that used with the pneumatically operated signal. When using high main reservoir pressure, it has been found advisable to insert a choke in the pipe connection leading to the whistle, having a 3/64 in. opening, to prevent the whistle from screeching.

A combined car discharge valve and train signal switch is designed to cover the transition period on steam trains. It is the ordinary car discharge valve, having a set of contacts added, and arranged so that when the cord is pulled the car discharge valve is opened and at the same time contact is made so that the signal will be transmitted electrically or pneumatically according to which system is used.

A test train, consisting of an engine and twelve steel cars, was operated for a period of four months, on the Pennsylvania Railroad, with such satisfactory results that the electro-pneumatic signal was recommended to be applied to all new equipment.

The electro-pneumatic signal, whether installed with low voltage battery current, or high voltage line current, is instantaneous in its action, reliable, and can be depended upon to transmit signals correctly and distinctly, eliminating entirely the elapsed time between the pulling of the cord and the signal reaching the engineer, no matter how fast the cord is pulled, or how short an interval is allowed between the blasts. With this signal system it would be possible to have a code in which long and short blasts were used, and thus increase the extent of communication between the train and the locomotive without using a large number of blasts. A test was made in which the signal cord was pulled seventeen times in a period of five seconds, and all of the signals were correctly transmitted.

It is free from false signals, and very economical to maintain, having no rubber diaphragms or hose connections to deteriorate, or any parts requiring expert repairmen for delicate adjustments. The operation of this signal on 90 cars during the past six years has shown its reliability and low cost of maintenance, requiring no periodical inspections.

DISCUSSION

It was explained further that by placing a whistle on each car it would be possible for the engineer to transmit signals to the train crew which on long trains is of decided advantage, as it is often difficult for the steam whistle signals to be heard from the rear of the train. The air for the car whistles could be taken direct from the train line or auxiliary reservoir and in this way eliminate the signal pipe. If there are no wire jumpers between the cars the wires for this signal could be built in the train line air hose between the inner tube and the outer wrapper.

AIR BRAKE HOSE

T. W. Dow, of the Erie Railroad, gave a brief outline of the new specifications of air brake hose adopted by the M. C. B. Association, stating that he believed that if these specifications are rigidly adhered to there will be much less trouble with the air hose than has heretofore been experienced. While this hose will cost a little more than the hose previously purchased, there is no question but that it will prove more economical in the end. He laid special stress on the gaskets for the couplings, stating that he has found that unless they were true to dimensions they would be very inefficient. Too much care cannot be taken to see that the hose is received true to the specifications, and by so doing a great deal of expense may be eliminated and much better results will be obtained.

Other members expressed the opinion that the practice of mounting hose by hand is much more efficient, as the inner tube is not so liable to become ruptured. However, this opinion was not general throughout the association, as many have found

where hose are mounted one end at a time on a machine that excellent results have been obtained. C. W. Martin, of the Pennsylvania, stated that he had made a comparison between hand-mounted and machine-mounted hose, and had found no particular difference in the service given.

Several members expressed the opinion that better results would be obtained by removing all hose after a certain period of time, preferably when the guarantee had expired, as by doing this, although the hose may be in good condition, many failures would be eliminated and the cost of damage to equipment decreased a sufficient amount to pay for the difference in the value of the hose removed. The Duluth, Missabe & Northern makes a practice of removing all hose after two years' service. In comparing the service after this new rule had been put into effect it was found that the hose trouble was decreased by 60 per cent. The Santa Fe reported that they were having as much trouble with the present M. C. B. hose blowing off from the connections as they did before. Some members, however, believed that this might be due to pulling off rather than blowing off.

MODERN TRAIN BUILDING

George W. Noland, P. C. C. & St. L., presented an interesting paper on this subject, in which he impressed upon the members of the association the importance of placing the light capacity cars at the rear end of the train; also the old cars that are of insufficient strength or that have inefficient draft gear. He cited several instances of disastrous results where this had not been done. He also showed six examples of trains varying from 31 to 80 cars in length, where up-to-date practice in train building had been used or neglected. He then showed how easy it would be to put the bad trains in proper condition, citing instances where this had been done and giving the amount of time consumed.

Special stress was paid to the importance of placing the 40,000, 50,000 and 60,000 lb. capacity older equipment at the rear end of the train. Frequently, he said, this practice has been adopted, even though the weaker equipment was the first to be taken out of the train. He made it clear that in order to get the best results the strictest co-operation must be obtained with the transportation department men, and reasoned that, if the importance of this proposition was presented in its proper light, the transportation department would be willing to allow time to put the train in proper shape. A little more time at the terminal might mean the saving of considerable time out on the road, especially when having to set out cars on account of break-in-twos.

The discussion of this paper was very freely participated in, and the question of the braking force of empty cars was considered. It seemed to be the general opinion that the practice of the Lackawanna and the Santa Fe of mixing one-third of the empties in the front part of the train and two-thirds of the empties in the rear is the best. Several instances were cited where the position of the inefficient equipment had resulted in serious mishaps. Every air brake man should do what he can to see that the trains are made up properly and with as few possibilities of break-in-twos as possible, as they are often held responsible for break-in-twos that are not their fault. They must seek and gain the co-operation of the transportation department.

AIR BRAKE EFFICIENCY

Fred von Bergen, of the Nashville, Chattanooga & St. Louis, introduced the subject by a short paper, in which he claimed that it was impossible to maintain brakes at 100 per cent efficiency. However, other members brought out the point that by setting a standard of the number of brakes which should be operated in a train and a certain definite degree of effectiveness for each brake as 100 per cent efficiency, this could be maintained. Mr. Wood, of the Santa Fe, explained the system on that road, stating that before a train leaves the terminal all brakes must be in operating condition, and to this end they have had as many as 100 cars set out at Kansas City in 24 hours, on account of their brakes not being operative. He mentioned that in order to do this the air brake men must have the co-operation of the transportation department, and that if orders are issued, little trouble is experienced in this respect. Before a train leaves a terminal on the Santa Fe it is stretched and the brakes are set so that inspectors may readily determine weak draft gear and inefficient brakes. He stated that at one of the large terminals 16 men split into crews of two men each will handle from 65 to 75 cars per day.

Mr. Sitterly stated that he believed the M. C. B. rules should be changed to make the car owners responsible for more of the brake troubles so that more care will be taken in maintaining the air brakes in good condition. Another member stated that he believed the irregular piston travel gave the greatest trouble, and that prompt attention on the part of inspectors would give the desired results. Mr. Turner concurred in these remarks, stating that a uniform piston travel should be had throughout the whole train, and in addition the foundation gear should be kept in good condition.

The trouble of imperfectly cleaned brakes was also mentioned. This has been evidenced by the defective condition immediately after cleaning. It was stated that on examination out of 500 brakes that had been cleaned 20 per cent were found defective one month after cleaning, which clearly showed that the work had been poorly done.

DEVELOPMENT OF THE UNIVERSAL CONTROL VALVE

Walter V. Turner, chief engineer, Westinghouse Air Brake Company, presented an illustrated lecture outlining the development of the UC-E triple valve. Mr. Turner showed a number of lantern slides, starting with the simplest form of universal valve, which he called the fundamental valve, and ending with the complete diagram of the UC-E valve, as shown in the illustrations. The illustrations were shown in logical rather than chronological order so as to give a clearer idea of the purpose of each improvement. To the fundamental valve was added the resistance increasing function, the object of which is to give a greater resistance to application than is given the resistance to release. The added resistance to application gives the brake a needed stability against application, which might be caused by unavoidable fluctuations in brake pipe pressure. On the other hand, when a release is desired the resistance to movement is, as it should be, the least possible.

The next development was the service port protection function, the object being to make certain that the auxiliary reservoir will be connected to the brake cylinder when a service application is desired. The next improvement was a redesign so that chokes could be inserted in the service and release ports in order to proportion them to the different sizes of brake cylinders used. This permits of using the same type of valve for different equipment, thereby reducing the number to be kept in stock. The next step was an addition of another slide valve which separates the service and release ports. This was done so as to eliminate the necessity of having a large slide valve which would be necessary for brake cylinders of increased size. The second valve is not directly affected by changes in the brake pipe pressure, but is controlled, instead, by the movement of the equalizing slide valve. The next step was the addition of a passage which, just before the feed groove opens, connects the auxiliary reservoir side of the equalizing piston to the atmosphere. This reduction of pressure insures the equalizing slide valve moving to the full release position, which, in turn, insures the release slide valve moving to its full release position. This eliminates a sluggish release.

The next step was the addition of a quick recharge reservoir. This reservoir is not used in making service applica-

tions, but simply for obtaining a quick recharge of the auxiliary reservoir. The effect of this quick recharge is to keep the brake system charged to its normal pressure at practically all times, so that a prompt response may be secured at any time, to the proper brake valve manipulation. The equalizing slide valve controls the movement of the release piston; that is, the movement of the equalizing graduating valve connects one or the other of the end chambers of the release piston to the atmosphere, which results in the quick recharge reservoir air which fills the release piston chamber, forcing the release piston to assume the position desired. This feature also provides for a graduated release. The quick recharge function insures the conservation of brake pipe pressure, or rather, the most rapid rise of brake pipe pressure consistent with the capacity of the brake valve. This will

In the next step the quick recharging of the auxiliary reservoir was carried to a greater refinement, being necessary when large auxiliary reservoirs are used. The ordinary single auxiliary reservoir is divided into two reservoirs, one called the auxiliary and the other the service. A charging valve is introduced which provides that the auxiliary reservoir shall first be charged, both from the brake pipe and the emergency reservoir. After the auxiliary reservoir is charged practically to the normal brake pipe pressure the service reservoir will be charged along with the auxiliary. The charging valve is so proportioned that when the auxiliary reservoir is within about 5 lb. of being completely recharged, connection is made with the service and quick recharge reservoirs, thus connecting the auxiliary, service and quick recharge reservoirs with the brake pipe. This permits of brake applications in rapid

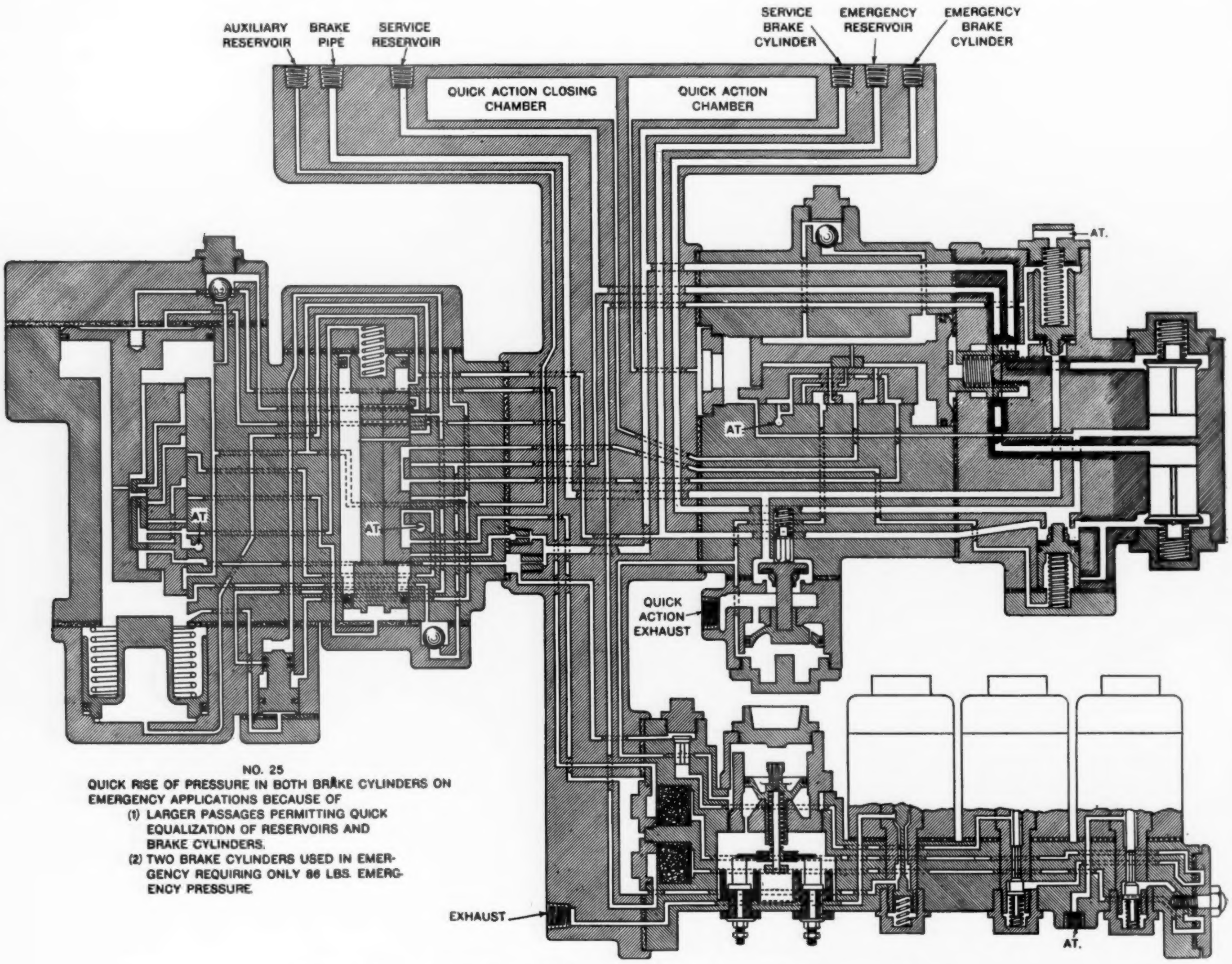


Fig. 1—Final Stage in the Development of the Electro-Pneumatic Brake

tend to eliminate to a large extent the trouble with truck brakes. In trains with mixed cars, some having the graduated release and others not, it may be desirable to cut out the quick recharge function and the graduated release.

The next step was the application of the graduated release stop, which provides that in graduated release the equalizing slide valve shall occupy such a position that the graduating valve can control the movement of the release piston, and that in direct release the slide valve will blank one of the passages to the release piston which will prevent the graduating valve controlling its movements. This eliminates the possibility of the brakes creeping on due to slight variations in brake pipe pressure.

succession and also gives greater flexibility in graduated release. Another function is that when reapplying after a graduated release the cylinder pressure may be so increased as to correspond closely with the brake pipe reduction. This gives the cylinder pressure a constant relation to the brake pipe reduction made, whether in graduated or direct release.

The next development was the quickly recharging of the service reservoir when the valve is arranged for direct release only. This function was introduced because in order to make applications at short intervals it is necessary that the brake system be maintained at as nearly the normal brake pipe pressure as possible.

The next point in the discussion of this valve was the

emergency features. The emergency functions are entirely separate from the service functions, which does away with all trouble from undesired quick action. The emergency slide valve only will operate when the rate of reduction in train pipe pressure is that corresponding to an emergency reduction. The service rate of reduction is only sufficient to cause the emergency slide valve to move to such a position that the quick action chamber air is vented to the atmosphere, which prevents the emergency valve jumping to the emergency position. This also permits of securing quick action at any time regardless of whether a service application has preceded or not.

The next step was the connection by which the quick recharge reservoir is to be used as an additional reservoir for

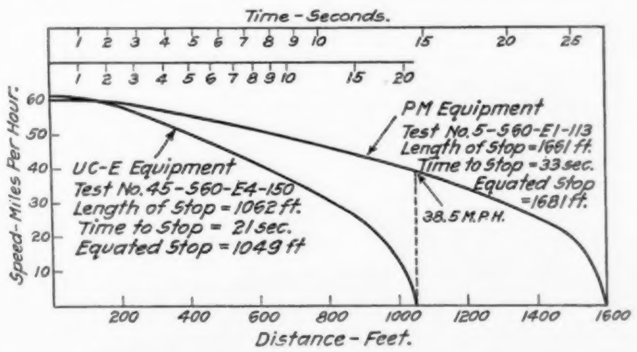


Fig. 2—Results of Tests of Emergency Stops

emergency application. A valve termed an emergency valve is introduced to connect the emergency reservoir to the brake cylinder after the emergency slide valve has moved to the emergency position. Arrangement is also made for the connection between the brake cylinder and the safety valve to be closed so the brake cylinder pressure secured by an emergency application may be retained throughout the stop. In order that the quick action valve may remain open for a time sufficient to reduce the train pipe pressure the desired amount a quick action closing chamber has been introduced. Since the equalizing of pressure of the auxiliary and service reservoirs with the brake cylinders in service stops considers a greater cylinder pressure than that from which the service braking ratio is realized, a safety valve has been introduced to prevent an overcharge of the brake cylinder and thus eliminates wheel sliding.

The next step is the addition of an intercepting valve which in an emergency stop after the service reservoir has been equalized with the brake cylinder cuts off this service reservoir and allows the emergency reservoir to equalize with the brake cylinder. By doing this the disadvantage of increasing the cylinder volume is eliminated. When the emergency slide valve is moved to the emergency position the intercepting valve permits the direct passage of air from the service reservoir to the brake cylinder, and after this pressure has been equalized it will move back to its former position, which connects the emergency reservoir to the brake cylinder, giving the high cylinder pressure desired. A bulb check valve is added to prevent the high pressure from flowing to the equalizing piston chamber which would require a considerable amount of air to release the brake, and delay the release from each emergency application.

The next step is the introduction of a protection valve which is so adjusted that when the brake pipe pressure is reduced for any reason whatever to a predetermined minimum it will open a vent to the air, making an emergency reduction which will set the emergency brake.

The next step was to separate the quick recharge cylinder from the emergency function, the special emergency reservoir being used to give the high pressure necessary in the brake cylinder, leaving the quick recharge reservoir to give the quick recharge function.

Electro-Pneumatic Brake.—The sole function of the electrical control is to secure a simultaneous application of all the brakes, regardless of the length of train, and it in no way increases the braking force obtained from any given brake.

To this final development of the pneumatic brake is applied a magnet valve called the "service magnet," which, when it is desired to make a service application, opens a poppet valve permitting brake pipe air to escape to the brake cylinder. A brake pipe reduction is thus made at each car, the effect of which is precisely similar to the effect produced by making a brake pipe reduction at the engineer's brake valve. The air from the poppet valve to the brake cylinder passes through a choke which gives the proper reduction in the train pipe for a service application. A check valve is inserted in the passage to prevent any back flow of air from the brake cylinder to the brake pipe The passage leading from the brake pipe to the magnet valve may be cut out when desired, thus cutting out the magnet valve.

The next step is the electrical control of the release. Another magnet valve is provided to control the opening and closing of the exhaust passage from the brake cylinder. When the engineer's brake valve is moved to the release position such connections are made that the release magnet is energized and the magnet valve closed, but the pneumatic release functions are not interfered with in any way. By moving the engineer's brake valve to running position the release magnet is de-energized, which causes the magnet valve to open, permitting the brake cylinder air to escape. With the engineer's valve in holding position the magnet is again energized and the release of air from the brake cylinder stops. Thus it may be seen that the brakes may be released by very small increments by alternately moving the engineer's valve from running to holding position. This also gives an opportunity to permit the brake system to recharge before the brakes are fully released.

The third step in the addition of electrical control is that for emergency application. This valve opens a connection

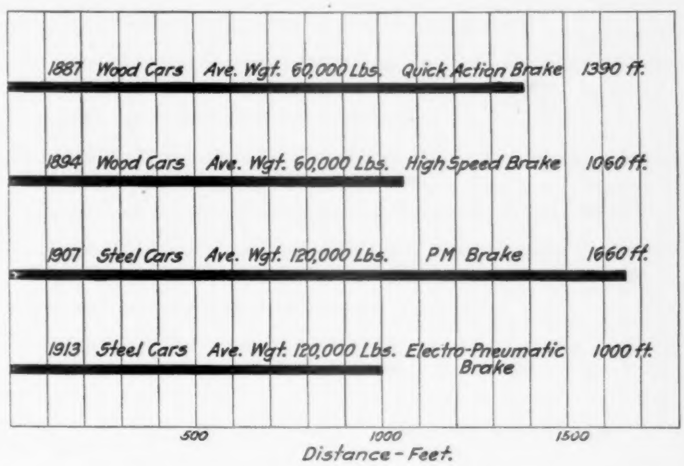


Fig. 3—Comparison of Emergency Stops

between the brake pipe and the atmosphere and operates similarly to the pneumatic operation, except that the action is simultaneous on all cars, the only difference being that it is obtained in much quicker time.

Fig. 1 shows the final stage in the development in the electro-pneumatic brake, with the addition of the electric switch, which operates the emergency circuit whenever any triple valve in the train goes to the emergency position from any undue cause, such as break in hose, conductor's valves, etc. If a higher braking ratio is required for emergency stops than that which one brake cylinder will give, it is possible

to provide two brake cylinders, one for both service and emergency and one for emergency exclusively. Provision is also made for securing a very rapid rise of pressure in both the service and emergency brake cylinders in emergency application. This completes the general story of the development of the universal control electric brake.

Figs. 2 and 3 show the wonderful results obtained by the use of this new type of brake. Fig. 2 is the result of tests with the emergency stop, contrasting the PM equipment with the electro-pneumatic equipment. It will be seen that from 60 miles an hour stops are made with the UC-E equipment in a little over 1,000 ft. at a point at which the train with a PM equipment was running at 38.5 miles an hour.

Fig. 3 shows the comparison in emergency stops at 60 miles an hour with various air brake equipment and typical trains dating back to 1887, 1894, 1907 and 1913. This diagram shows that, notwithstanding that the 1913 train weighed twice as much as the 1887 train, the stop was made in about three-quarters of the distance.

ELECTION OF OFFICERS

The secretary reported a membership of about 1,200, and a cash balance of $1,324.58. The following officers were elected for the ensuing year: President, L. H. Albers, New York Central Lines; first vice-president, J. T. Slattery, Denver & Rio Grande; second vice-president, T. W. Dow, Erie Railroad; third vice-president, C. H. Weaver, Lake Shore & Michigan Southern; secretary, F. M. Nellis, Westinghouse Air Brake Company; treasurer, Otto Best, Nathan Manufacturing Company. New members elected to the executive committee were L. C. Streeter, Illinois Central, and Mark Purcell, Northern Pacific.

FREIGHT CAR DESIGN AND CONSTRUCTION*

BY W. M. BOSWORTH

There is no doubt that more economical and efficient designing of freight equipment would result in great saving to the railways. A great deal has been said in the last few years regarding the general and detail design of freight cars, and the standardizing of more freight car parts. This would not only make a saving in maintenance, but would reduce the first cost of the car, and the vice-president of one large car company has gone so far as to suggest the standardizing of all freight equipment.

The railways are in a better position to supervise the designing of cars than the car companies, as they are continually encountering the weaknesses of past designs. Specifications and general drawings should be made in the mechanical engineer's office and advance copies submitted to car department heads, master mechanics and general car foremen to obtain their criticisms and recommendations for strengthening the weak points. The facilities available for car repairing should have little bearing on the design, especially if the road is well equipped with modern car repair shops, as it must be remembered that roads with little or no facilities, as well as the owning road, have to repair the cars.

The failure of car parts should be reported to the superintendent of motive power on specially prepared forms so that proper means can be taken to reinforce the weak points, after a sufficient number of like failures have occurred in fair service to indicate weak design. This will also materially help in framing specifications for new cars. Too frequently the desire on the part of railway officers to cut down the first cost is the cause of weakly designed cars, on which it is afterward necessary to spend several times the original difference in first cost to keep the cars in condition to earn maximum revenue.

*Entered in the Car Department competition which closed February 1, 1914.

There are differing opinions regarding the use of structural and pressed steel in car construction, but it would seem that the advocates of structural steel are in the majority, and there is no doubt that repairs of foreign cars would be facilitated if, instead of so many pressed steel parts, structural steel were used. The writer has known cases where foreign cars have been kept on repair tracks for six months awaiting pressed steel material, whereas they could have been in revenue service in a short time if the parts had been of structural steel. It has been stated that rolled shapes cannot be had on account of the mills not having them in stock, but if the railways would make a more general use of this material and certain sizes and shapes of rolled steel could be decided upon by the Master Car Builders' Association, the demand would be increased and the mills would then arrange to have these sizes on hand. One of the large roads has adopted a design of box car having pressed steel posts and braces of U-shape section, and while this is the strongest design per unit of weight, yet if a number of these posts were torn off on a distant foreign road, it would be impossible to duplicate them and it would either be necessary to await shipment from the owner or car builder, or send the car home empty.

THE UNDERFRAME

There are numerous designs of steel underframe in existence, but it is generally agreed by the majority of railroad men that the fishbelly type of center sill is the most desirable, because there is a better distribution of metal and the stresses are more nearly uniform. Center sills should be built up of plates and angles, the webs being not less than 5/16 in. thick and the chord angles and cover plates of a size to suit the weight and capacity of the car. It is agreed that top cover plates should run the full length of the car, and some car men advocate bottom cover plates; but these are not necessary if bottom chord angles of proper size are used. Others advocate center sills continuous to the end of the car, but it is the practice of a number of large roads to splice Z-shaped draft sills to the center sills ahead of the bolsters, and this design is giving satisfactory service.

The side sills are also of numerous shapes, some being fishbelly, others straight pressed sections and others rolled sections. Here again a straight rolled section is advantageous, as it permits of a close inspection of brake rigging, especially on long trains at terminals where there are short stops and a limited number of car inspectors. If cross bearers and bolsters are of ample strength the rolled side sill need only be strong enough to take care of the load between these lateral members. Side sills should also be high enough above the rail to permit complete opening of the journal box lids.

End sills can also be built up of rolled sections to advantage. The bolsters and deep cross bearers, however, can with advantage be of pressed section, and if these parts should be standardized all railway repair shops would probably in a short time be equipped with dies for straightening them, so that there would be little difficulty in repairing steel underframes.

Some designs of underframes make use of crossties or needle beams which pass through the center sills, but in order to get these out in case of repairs it is necessary that the side sills be set on top of them. This is not good construction, as a derailment would bend them out of shape, whereas if they are set flush with the side sill at the bottom and a fishbelly center sill is used the car can skid along with the least damage to the underframe. Cross bearers should preferably be as deep inside as the center sills, have ample top and bottom cover plates, and substantial fillers between the center sills. The underframe and body as a whole should not be so rigid that it will not take low joints at diagonally opposite corners, as this will cause derailments.

Center plates should be backed up with substantial steel castings riveted between the center sills and substantial steel buffer

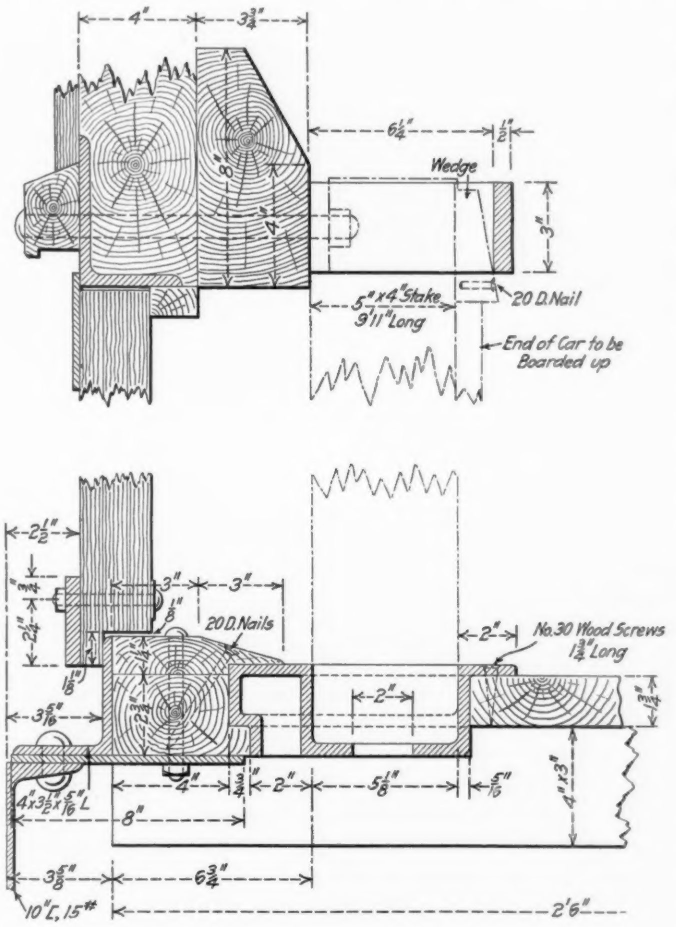
castings used. These castings should not be too light, a thickness of ⅝ in. being about the minimum, as ½ in. cast steel, when pouring, will congeal before entirely filling the mold if the heat is not exactly right and imperfect castings are the result. Center plates should be lipped over the bolster bottom cover plate to help take the shear off the rivets.

In designing the car generally, care should be taken to see that no part which is apt to require frequent attention or repairs is overlapped by some other part as this condition may more than double the cost of making the repairs.

With a center sill cover plate running from end to end of the car it would seem that the diagonal braces should be run from the corners to the intersection of the center sills and bolster instead of from the end sill at the center to the bolster at the side sills. More benefit will be gained from the braces in this position. Moreover, draft and center sills should be made stiff enough to resist all buffing shocks without transmitting any of the force to the side sills.

BOX AND OTHER HOUSE CARS

The outside metal frame type of box car, with Z-bar posts and braces and single inside lining, has fast come into favor in the



Temporary End Reinforcement for Automobile Cars

past few years among a large number of railways and presents many advantages. The side posts and braces should preferably be attached to the narrow side sills through ample gusset plates to give them sufficient rivet bearing area, which will prevent the loosening at the side sill which has occurred on some cars without such plates. In some cases no bracing is used on the ends and apparently with good results, but better results can be obtained if a plate be run across the end of the car at the bottom, riveted to the top flange of the end sill and extended up for 15 in. to 18 in., and the end posts riveted to it. This allows one end post to be used as an inside end ladder rail, and also makes the brace from the bolster to the upper corner of the car unnecessary, as it carries the corner load over to the center sills.

The end doors of automobile cars are a continual source of trouble end expense, and it would be to the interest of all roads if they could arrange an agreement with automobile manufacturers whereby the end doors could be dispensed with and the double side doors used. The end doors not only get out of shape, but where it is desired to make a return shipment of bulk freight in an automobile car, it is necessary to supply a temporary end to protect the doors or the car will have to be returned empty. Of course if most of these cars are kept in the automobile manufacturing district they can usually be loaded, but if sent into an agricultural or lumber district, it is not safe to load them for return movement unless the end doors are protected. As this is expensive for the shipper, the car often returns empty. A method of protecting the end doors of automobile cars is shown in the illustration.

Large end doors have not been made satisfactorily water tight, and the writer believes that only small end doors should be applied, and these in all box cars, as they can be made water tight and will permit the loading of long lumber and similar material. Automobile cars would then become revenue earners in both directions.

The writer believes the outside metal roof to be the most satisfactory of the three types in general use. Some car men advocate the inside roof, claiming that the outside roof boards protect the metal and that it is impossible to keep the outside metal painted, resulting in its rusting out rapidly. They seem to forget, however, that it is impossible to keep the outside boards in such a condition that they will not permit water to leak through to the inside metal and corrode it, with no chance of detecting the leak from the outside. The outside metal roof can be kept painted, and if properly galvanized and provided with sufficient movement between the sheets should give the least trouble. At the same time the roof boards act as an insulator.

The all metal roof shows evidence of sweating on the inside when no ventilation is provided. However, this sweating will be reduced when the roof is ventilated, but there is still a question as to whether ventilation will entirely eliminate this feature which damages lading. The roof sheets should provide ample movement to accommodate the distortion of the car body when running over low joints, especially when loaded, and to provide for the end shocks which are always transmitted to the roof; the roof tends to remain stable, while the underframe is being moved by the shock. It is desirable to cover the roof boards with a layer of burlap soaked in a good tar, or lead paint, and apply the metal roof on top of this. It is also good practice to apply a layer of good waterproof tarred paper under the running board saddles, as this will prevent possible leakage.

DOORS

The question of making the side doors waterproof is one of next importance to the roof and with the use of the most improved types of fixtures the danger of leakage is reduced to a minimum. Some roads are using all metal side doors, but the least kink will make these inoperative, whereas the wooden door is resilient and will usually return to its normal position after a moderate shock.

One of the greatest causes of damaged doors is the fact that empty box cars never have the doors fastened, which allows them to shift to and fro under the movement of the car. If an open door lock or catch of substantial design were used and the door fastened when in an open position, a great deal of this damage to doors would be overcome, provided, of course, the men handling the cars would give this matter careful attention.

DRAFT GEAR

The most important detail affecting all types of cars is the draft gear. The friction type is now the recognized standard, as it absorbs a greater percentage of the shock than the spring

gear, with the least amount of recoil, consequently the minimum shock is transmitted direct to the center sills. Some large roads are using spring gear, apparently with good results; however, one road in keeping a record of failures of both spring and friction gears during a period of six months found the spring gear failures amounted to 81 per cent, while friction gears showed only 17 per cent.

Draft lugs should be of cast steel and of substantial design, with the front lugs arranged as a stop when the gear is solid. This will distribute the final shock over a larger area of the draft sill; if the key type of gear is used, a back stop is preferable.

Where the gear is of a type having springs on both sides of the transom, it is preferable to have a greater capacity for buffing than for pulling, but easy side movement of the coupler must not be overlooked. A flexible coupler centering device is a desirable feature and coupler side clearance should be such as to reduce lateral strains on the car body to a minimum.

TRUCKS

The Master Car Builders' Association already has a number of standards for trucks, but additional standards are desirable, such as the height of truck center plates and body side bearings from the rail, so as to make trucks interchangeable for cars of the same capacity. It is also believed that the standard M. C. B. center plate could be improved, as it has developed weaknesses. Center plates should be separate and be lipped over the bolsters, and side bearings should be adjustable to provide proper side bearing clearance at all times. Another important feature is the spacing of the side bearings from the truck center, which should be such that the car body will not tend to topple off the trucks nor to lift the trucks from the rail. A satisfactory spacing is about 25 in. from the center pin. Standard arrangements of brake rigging are also desirable. Bolster and column, or cast steel side frame fits should be standardized also, both as to vertical and horizontal dimensions, and trucks should be assembled in jigs to insure squareness, so all wheel flanges will wear evenly.

Lateral motion devices are being used by a number of large railways, and tests have shown that the resistance of trains is less when they are used, indicating a reduction in flange and rail wear. The lateral motion should not exceed 1 in. to 1⅛ in. on each side.

PAINTING

In general the steel underframe joints should have a good heavy coat of red lead put on with a stiff brush before assembling and the underframe should preferably have three coats of paint. Some car builders only give two and others go so far as to say one is sufficient. In applying three coats it is well to use a metallic brown for the first coat with a second coat of a darker brown, and the third an approved black. This color scheme will insure inspectors that all three coats are being applied. One coat of good truck black is usually sufficient for the trucks.

DAIRY REFRIGERATOR CAR

The Merchants Despatch Transportation Company, which is now controlled by the New York Central, has amongst its latest equipment some well designed and carefully constructed dairy cars. These cars are insulated with four courses of ½ in. Flaxlinum, and are provided with the Bettendorf steel underframe and trucks. They weigh 55,000 lb., and have a capacity of 80,000 lb. The superstructure is entirely of wood with the exception of the Murphy steel roof, which is applied over a 13/16 in. roof of yellow pine. The car is 40 ft. 5 in. long and has a capacity of 2,062 cu. ft.

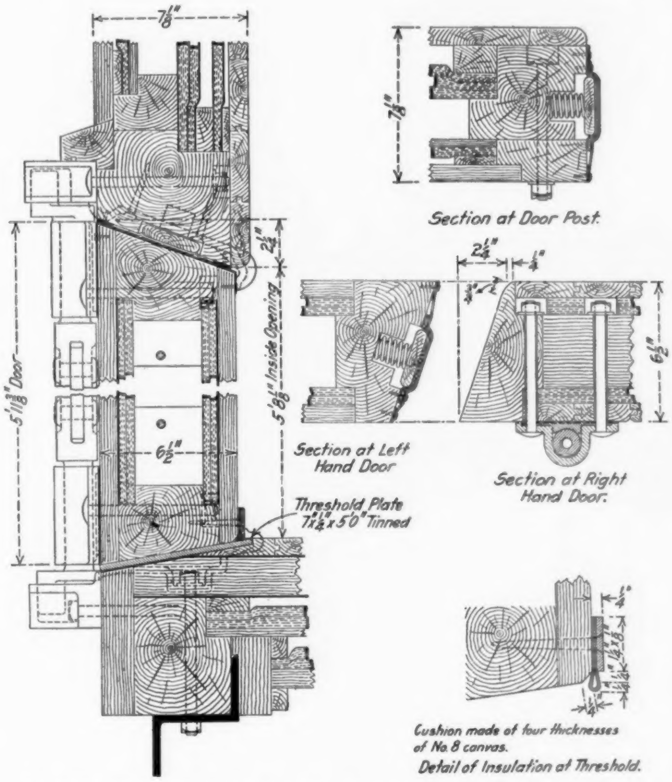
The superstructure being entirely of wood must be specially substantial to successfully withstand the shocks and strains received in service without injuring the insulating properties of the car. Extra care is required in this respect, as this type of car is so heavy. From a study of the car it is believed that these conditions have been adequately met. The end sills are 6 in. by 4 in. oak beams mortised for the end posts and tank cripples, and secured to Z-bar and angle iron reinforcements by ⅝ in. bolts. The side sills are 5½ in. by 4⅜ in. long leaf yellow pine, and are secured to Z-bar side sills with ⅝ in. bolts. There are six 4 in. by 4 in. intermediate sills of long leaf yellow pine which are secured to the cross ties and bolster members by ⅝ in. bolts.

The bottom course of the flooring is 1¾ in. thick and extends

Refrigerator Car for Merchants Despatch Dairy Line

from outside to outside of the side sills for the full length of the car. The top course is 13/16 in. cypress and extends from drip pan front to drip pan front of the ice tanks. A layer of burlap plastic is laid between the top and bottom courses. It is lapped at the center and extends 6 in. up on each side of the car.

The ice tanks have inside dimensions of 2 ft. 11¾ in. by 7 ft.

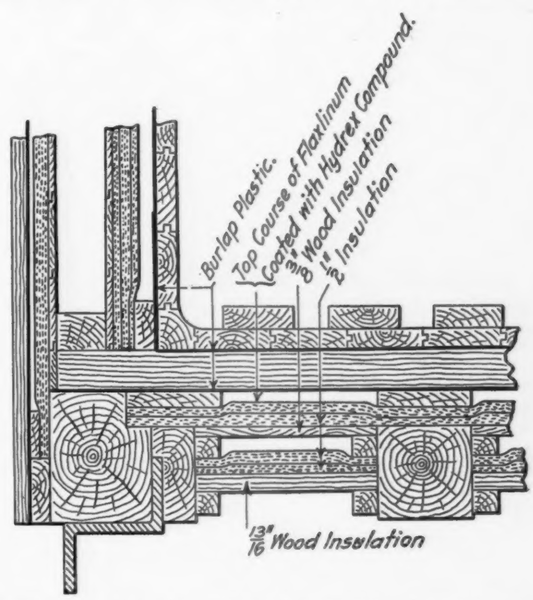


Sections Through Doors of the Merchants Despatch Dairy Car

10⅝ in., the distance between the bulkheads being 33 ft. The sides and ends of the tanks are lined with No. 24 galvanized iron to a height of 30 in. The drip pan is of No. 22 galvanized iron.

The ice bars and bulkhead supports are made of malleable iron. The ice bars are supported on six 4 in., 7.5 lb. galvanized I-beams extending the full width of the tank and resting on a Z-bar rear support that is bolted to the end framing. The bulkhead base is a 5 in. by 3½ in. by ⅜ in. galvanized angle extending the full width of the car and securely fastened to galvanized malleable iron columns. The bulkhead is made up of two 4 in., 7.5 lb. I-beams extending from the angle support to the ceiling for center posts, and three intermediate and two side posts of 2 in. by 5 in. long leaf yellow pine. The ice opening are 20 in. by 27 in. clear.

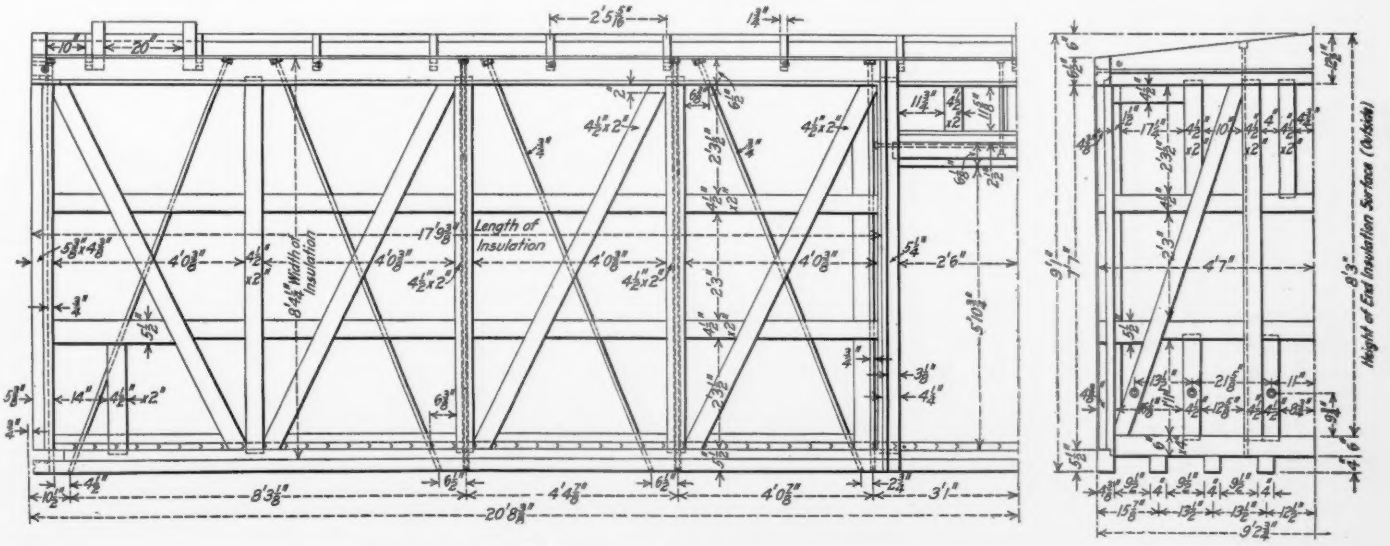
The door openings are 5 ft. 5 in. by 5 ft. 11⅛ in. high. The frames of the doors are of long leaf yellow pine. The door frame is first covered with a layer of the best quality of three-ply waterproof P. & B. Giant paper. The Flaxlinum is then



Section Through Side and Floor of Merchants Despatch Dairy Car

applied, two courses on each side of the frame with a layer of the waterproof paper between and on the outer surface. The doors are provided with the La Flare spring insulation. The insulation of the threshold consists of a cushion made up of four thicknesses of oil-treated Ontario duck canvas.

The cars are insulated with four layers of Flaxlinum. The side of the car frame is first covered with a layer of ⅜ in. wooden insulation, the joints of which are butted tight and the ends make a close union with the corner posts and door posts.



Arrangement of the Framing in the Merchants Despatch Dairy Car

A layer of three-ply P. & B. Giant paper is applied over this wooden insulation. One layer of Flaxlinum is then applied which is again covered with a layer of the same paper. This insulation is held in place by horizontal nailing strips, two at the side plate, two at the belt rails and one at the side sill. The

outside sheathing is nailed to these nailing strips. A side sill board is applied at the bottom edge of the side sill which forms a guide and rest for the insulation. The lower edge of this layer of Flaxlinum is waterproofed to a height of 8 in. The inside of the car frame is covered with a layer of 2½ ply waterproof P. & B. Giant paper which extends from the top of the 1¾ in. flooring to the side plate. Three layers of Flaxlinum are then applied with a layer of the waterproof paper between them. The inside course of Flaxlinum is waterproof to a height of 6 in. above the top of the floor. These three courses of insulation are secured by nailing strips at the side plate and the floor and at the posts. The inside lining is nailed directly to these nailing strips.

The underframe is insulated by two 1 in. layers of Flaxlinum composed of two courses each. The bottom layer is applied directly on top of the 13/16 in. insulation, which is held in place by nailing strips 1 in. square. This layer extends only between the intermediate car sills. An air space is provided between the bottom and upper layer. A second course of wooden insulation extends between the intermediate sills and is flush with the top of them. On top of this is applied the two courses of Flaxlinum, which extend the full width and length of the car in one piece, with courses of waterproof paper between them. On top of the top layer of Flaxlinum is applied a coat of Hydrex compound to thoroughly protect the insulation from moisture that may possibly leak through the floor. Another air space is provided between the top layer of Flaxlinum and the 1¾ in. flooring.

The roof of the car is insulated by four layers of Flaxlinum, the three upper layers of which extend between the carlines for the full width of the car. The bottom layer extends across the full width of the car and for the full length, underneath the carlines, in one continuous piece. Above and below this layer is applied three-ply P & G waterproof paper. This layer of insulation is held in place by nailing strips nailed directly to the carlines. The ceiling proper is nailed directly to these strips. The second course of insulation is applied directly on top of the lower course, being held in position between the carlines by nailing strips. An air space is then provided between this layer and the wooden insulation, which is 13/16 in. thick. On top of this wooden insulation is applied the other two layers of Flaxlinum, waterproof paper being applied between each layer. The roof is applied directly on top of the carlines, as shown in the drawing. On top of this is a layer of burlap plastic, on top of which is applied the Murphy steel roof.

The following are the general dimensions of the car:

Length outside of sheathing	41 ft. 6⅜ in.
Length over end sills	41 ft. 4¾ in.
Length inside of lining	40 ft. 4⅛ in.
Distance between ice tanks	33 ft.
Width over outside sheathing	9 ft. 5⅞ in.
Width inside of lining	8 ft. 3⅝ in.
Height of running board from rail	12 ft. 11½ in.
Cubic capacity	2,062 cu. ft.
Capacity	80,000 lb.
Light weight	55,000 lb.

Conductivity of Locomotive Exhausts.—The results of investigations of the electrical conductivity of the exhaust from steam locomotive stacks have recently been published showing why discharges from high-voltage trolley wires to locomotive stacks can occur through distances much less than usual when gases and vapor are escaping from the latter. Experiments show that the greater conductivity under these conditions is due to the ionization occurring in the space between the wire and the track, produced by the friction of the escaping gases and moisture. Experiments were made with a locomotive under a wire and with its blower closed, half open, and wide open. The breakdown voltages between wire and stack were compared with those required to break down the same length of air path with the locomotive removed. On the average it required about one-half the voltage to break down the air with the locomotive present.—*The Engineer.*

REFLECTOR FOR OBSERVATION CAR WINDOWS

BY R. S. LOWDER

A reflector somewhat similar to the type used on automobiles has been applied to the observation end of a private car recently built by the Pullman Company.

The reflectors, one of which is applied to each rear observation room window, enable the occupants to see ahead of the train by glancing out of the side windows. They are so arranged that they can be quickly folded against the side of the car when so desired. The location on the car is shown in the accompanying illustration.

The reflector consists of a plate glass mirror set in a metal frame on which are cast lugs turning in brackets fastened on the side of the car. The mirror frame in service position is held at right angles to the window by a brace riveted to the side of the car. The brace is slotted to take a pin attached

Reflector for Car Window

to the outside edge of the mirror frame. A simple spring latch attached to the end of the brace locks the pin in the end of the slot, and holds the mirror securely in service position.

When it is desired to fold back the mirror the occupant of the observation room, by reaching out of the window and pressing outward on the projecting end of the spring latch, can disengage the pin, which is then free to move back through the slot. The mirror can then be folded back until it snaps into the spring clip on the side of the car.

To place the mirror in position it is only necessary to push outward on the end of the brace which, acting as a lever about its pivot, will disengage the frame from the clip and swing it outward until it comes within reach. It can then be pulled forward until locked in position by the spring latch.

Power in the United Kingdom.—At a recent meeting of the Manchester (England) Association of Engineers, Edward G. Hillier stated that the total horse power in use in the United Kingdom was 10,578,475, nine-tenths of which was provided by steam engines. Steam turbines rated second in the list, gas engines third, and water power fourth.—*Power.*

SHOP PRACTICE

PLANT FOR REPAIRING BOILER TUBES

BY R. C. POWERS

The Baltimore & Ohio has installed at the Mt. Clare shops a plant for repairing locomotive boiler tubes. The accompanying engraving will give an idea of the layout as well as the process of handling.

The plant was designed to keep up with the demands of the 60 or 70 boilers per month going through the shops, and several small outlying stations. Prior to the construction of this plant the work was divided between the boiler and the smith shops, the former repairing the tubes for Mt. Clare and the latter for the outlying stations. But with the increasing demand for space in the boiler and smith shops, together with the advent of the 5½ in. tubes for superheater locomotives, it became necessary to construct a new plant. It was then decided to concentrate all tube work at Mt. Clare. Not being able to construct the plant in or adjoining the boiler shop because of lack of space, the present location, which is about 800 ft. west of the erecting shop, was decided upon.

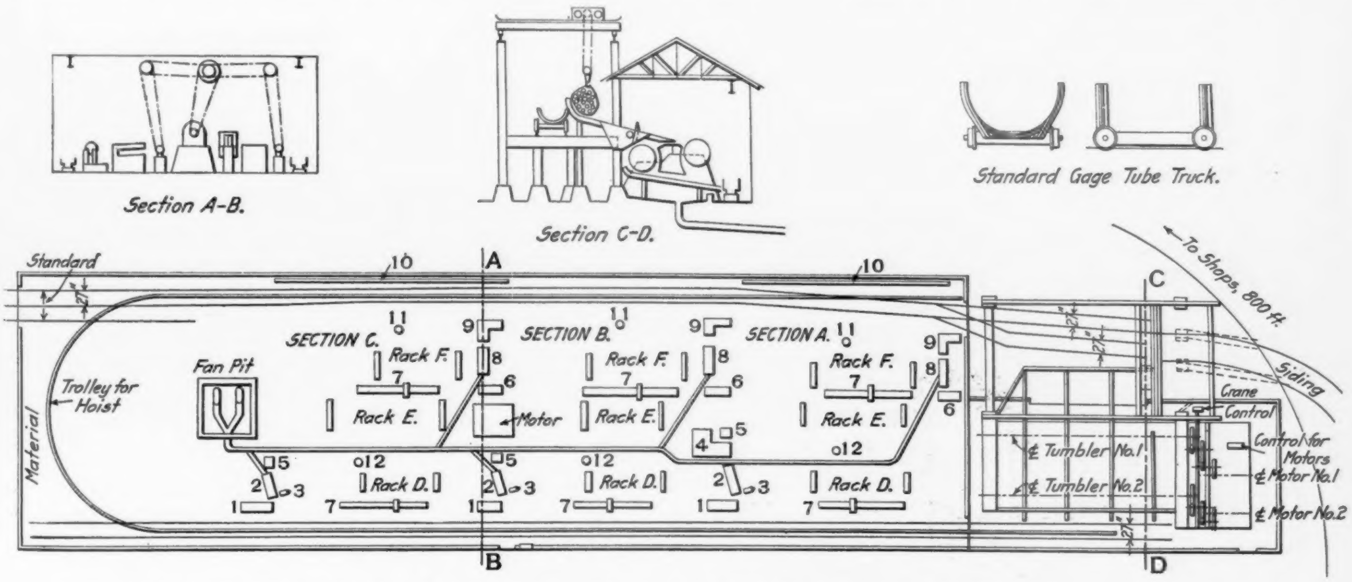
The old tubes when removed from the boiler are put on a rack so that they may be transferred by a crane to one of the standard gage trucks on which they are taken to the stub switch siding in the tube plant. This siding is about 12 ft. above the floor of the plant. The tubes are taken from the truck by means of a crane and placed on the runway over the tumblers. This runway is built of 1 in. by 4 in. iron placed on edge, supported by a 12 in. I beam over the tumblers and braced with ½ in. plates. The outer end of each piece is supported by a 4 in. I beam placed on end in concrete. A stop or gate is provided to regulate the number of tubes going into the tumbler, and there is also a guide to direct the tubes into the desired tumbler.

The tumblers are of the type in general use, being driven by a 35 h. p. electric motor through a chain of gears, and elevated to allow the tubes to drop out to a runway which delivers them to a 27 in. gage truck. The truck is then pulled into the repair section.

Tubes are taken from the truck, the ends are cut off by cutter *No. 1*, and they are then placed on rack *D*. They are next heated in furnace *No. 2* and scarfed on tool *No. 3*, the safe ends are applied and the tubes put in furnace *No. 2* for a welding heat. After welding to the approximate length and shouldering on machine *No. 4* or *No. 5*, as desired, they are placed on rack *E*. From this rack the tubes are taken and cut to the exact length with cutter *No. 6* by means of gage *No. 7*, and then placed on incline rack *F* with the ends in furnace *No. 8*. When the desired heat is obtained the ends are expanded on machine *No. 9* and the tubes then placed on a truck.

A hydrostatic test is made on machine *No. 10* as the tubes are taken from the truck and placed on another. When the required number of tubes is obtained for a locomotive, the truck is pushed out to the crane, and by it the tubes are put on a standard gage truck and returned to the erecting shop. Section *A* is fitted to repair tubes of any diameter between 1¾ in. and 5½ in. by adjusting or changing tools. Sections *B* and *C* are used for tubes 1¾ in. to 2½ in. in diameter; the three sections are the same except that the Hartz rotary welding machine and additional dies are used in section *A* on the large tubes. The tubes are usually kept in sets as removed from the boilers on account of the different lengths. When tubes are received from outlying station they are handled by the crane as above.

The building is 45 ft. by 180 ft. with a depth of 20 ft. under the bottom chord of the roof truss. It is of wood construction and is covered with sheet iron over 1 in. sheathing. The foundations for the building and all the machines are of concrete, as are also the basins under the tumblers, these being fitted with a drain pipe. Large windows have been provided to give plenty of natural light. Fine stone screenings were used as a floor. The following equipment is installed:



Baltimore & Ohio Boiler Tube Repair Shop; the Curved Line at the Right Represents a Bulkhead Supporting the Tracks

1 10 ton electric crane.
2 28 ft. by 48 in. diameter (inside) tumbling barrels for cleaning (used with water).
3 cutting off machines (No. 1).
3 furnaces (No. 2) for welding and shouldering.
3 tools for scarfing ends before welding (No. 3).
3 McGrath pneumatic hammers (No. 4) for welding and shouldering. (See July, 1912, American Engineer, p. 357.)
1 Hartz rotary welding machine (No. 5) driven by an electric motor (used for 5½ in. tubes).
3 cutting off machines (No. 6).
3 inclining furnaces (No. 8) with rack *F*.

6 cutting off guides and gages (No. 7).
3 pneumatic expanders (No. 9).
2 boiler tube testing machines (No. 10) (shown on page 484 in the September 1912 issue of the American Engineer).
3 portable tube rests (No. 11) fitted with rollers for one tube.
3 portable tube rests (No. 12) fitted with rollers for three tubes.
2 No. 5 Sturtevant blast fans in pit 9 ft. by 9 ft. by 3 ft. deep.

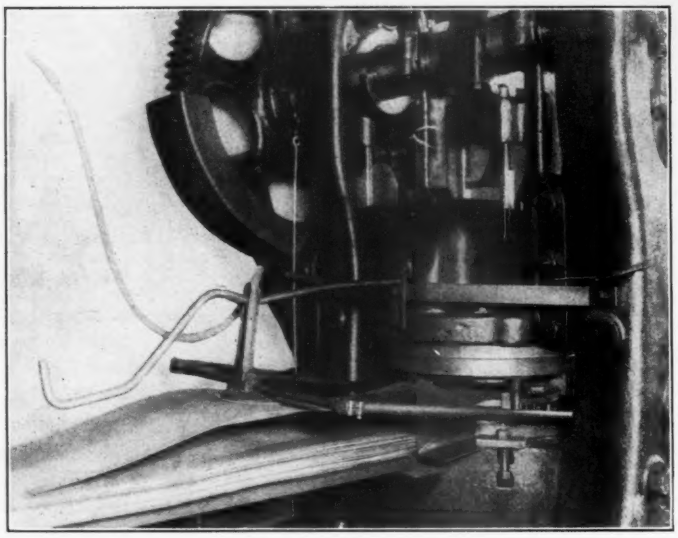
The plant is piped for cold water, air and crude or fuel oil at 100 lb. per sq. in. The crude oil is used in the furnaces. A 27 in. gage track extends the full length of the shop on each side for the use of the small tube trucks. A 15 in. I beam extending the full length and connected at one end is used as a trolley for a 4-ton Sprague hoist. The motors, crane and hoist are of the 500 volt direct current type in general use.

Artificial light is obtained from twelve 250 watt multiple burning tungsten lamps on 110 volts. The fan pit, and all machines having belts, are protected by guards built of pipe. Sufficient heat is obtained from the furnaces without any heating system. All the machines and tools, except the fans, motors, hammers and hoist, were made by the shop forces at Mt. Clare.

The truck illustrated is one of the standard gage tube trucks used to take the tubes from the boiler shop to the tube plant and return. The 27 in. gage truck is of similar design, each having 12 in. wheels fitted with roller bearings. The frame is of 2 in. angles, with 2½ in. by 4 in. steel for the axles. There is also a standard gage track entering the shop at the north end which can be used in case of emergency. This track connects with the east end of the boiler shop, which is about 2,000 ft. away.

VACUUM LIFTING DEVICE

For some time the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., tried mechanical safety devices of various kinds for the punch shop, but with unsatisfactory results. The operators found them unsuited because of the fact that they tended to retard the production and consequently their earnings, while the management also objected to them because they afforded only partial protection,

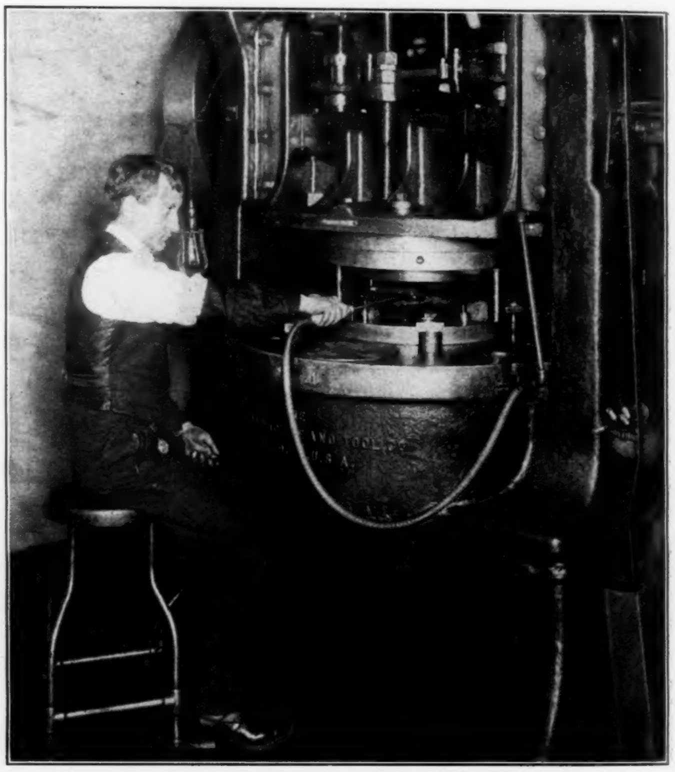


Safety Suction Device Used on Punch Presses

as the operator had to place his hand under the press in every instance, in order to remove the scrap.

The vacuum lifting device shown in the illustrations enables the operator of a punch press to dispense with the helper, and at the same time all danger to the hands is removed. This consists of a "sucker" or lifting device about 8 in. in diameter, which is connected by means of a rubber hose to a suitable suction line and which is further free to move on an irregularly shaped rod, its length of travel being controlled by the press hand through the medium of two guide arms or handles, one on either side of the punch and die; that is, just inside of the press housings.

When a pile of metal sheets is placed in the rear of the press preparatory to being punched, the press hand on the opposite side of the press pushes the guide arms through the press towards the pile. The irregularly shaped rod allows the "sucker" to drop until it rests on the top sheet of the pile, when a lever on one of the two guide arms is pressed, thus opening the suction valve and causing the "sucker" to grip the sheet. The guide arms and the suction lever are not released until after the first blank has been punched. By thus retaining hold of the guide arms, practically all danger



A Hand Adaptation of the Safety Suction Device

of injury to the hands is removed, for in punching the succeeding blanks, the operator can almost invariably pull the sheet forward by means of the scrap or margin.

Since the adoption of this suction device there has not been an amputation on the large presses and up to the present no fingers have been amputated in the punch shop. The device was exhibited and received the grand prize at the recent International Exposition of Safety and Sanitation in New York City and is now on exhibition in the American Museum of Safety there.

SMOKE PREVENTION SCHEMES.—That the smoke difficulty with steam locomotives is a real one may be at once admitted; but that the solution lies in distributing the smoke behind or under the train cannot be accepted. Yet, from the earliest days of the steam locomotive until now, inventors have proposed all sorts of ideas of this kind. One of the most ingenious was tried years ago on the Metropolitan Railway. Between the rails a trough was laid, and the engine carried a sliding shoe device adapted to slide over this, and to open doors as it passed, whereby smoke led from the stack to the shoe was enabled to pass into the trough, thence being exhausted to a collecting plant. Other ideas consisted of extension stacks leading to the back of the train. And now another scheme of the same class is presented in which a smoke conveyor extends from the stack to a point at one side of the engine and near the rear driving wheel.—*The Engineer.*

Master Boiler Makers' Convention

Eighth Annual Meeting, Held in Philadelphia; Addresses by Ivy L. Lee, S. G. Thomson and Frank McManamy

The eighth annual convention of the Master Boiler Makers' Association was held at the Hotel Walton, Philadelphia, May 25-28. The first session was called to order at 2:30 p. m. on Monday, May 25, by the president, T. W. Lowe, general boiler inspector of the Canadian Pacific, and was devoted to addresses by Rudolph Blankenburg, mayor of Philadelphia; S. M. Vauclain, of the Baldwin Locomotive Works; Ivy L. Lee, chief executive assistant to the president of the Pennsylvania Railroad, and by the president of the association.

Mr. Vauclain's Address

Mr. Vauclain called attention to the fact that it is the care and maintenance of a boiler that exacts the greatest amount of attention and skill. It is a comparatively simple matter for a builder to construct a boiler in accordance with designs that have been prepared, and if he is honest and wishes to turn out good and reliable work it can be done; for the men in a shop are apt to be infused with the spirit of the employer. He insisted that the best of men were required for repairs and called attention to the difficulty of getting them. Young men do not take kindly to the boiler shop, but, in his opinion, that department is one of the most, if not the most important of the works. For that reason he advises all of his apprentices to spend a part, at least, of their apprenticeship in the boiler shop, because skill in that line promises better for promotion than any other. He considered that the work on the boiler required more skill than any other part of the locomotive, because of the nature of the material that is used and the necessity of being familiar with its every aspect, such as it flanging and bending qualities, in order that it may be rolled and bent into shape without injury. It also requires a high degree of technical skill in order that the foreman in the shop may be able to check and detect any inaccuracies that may be made in the drawings, for inaccuracies will creep in in spite of everything that may be done. It is this knowledge and technical skill on the part of the boiler maker that is necessary to avoid disaster both in the building and the repair shops.

It might be thought that the building of boilers was one long piece of routine work, but it is nothing of the sort. Each boiler presents new and individual problems that only the practical and skilled man in charge can solve, so that it is safe to say that the greatest amount of skill is required in order to become a successful boiler maker.

In replying to Mr. Vauclain, C. P. Patrick called attention to the great lack of boiler maker apprentices and urged the recruiting of their ranks in order that there might be a supply for the future. He also spoke of the work of the federal boiler inspectors and said that, when the law was first put in action, he regarded many of its provisions as unnecessary and as putting a hardship on the railroads. But after an experience with it of three years he had come to the conclusion that it was a good thing and had found that when a road was willing to meet the inspectors and show that it was endeavoring to do its best and keep its boilers in a good state of repair no difficulty was encountered.

Ivy L. Lee's Address

Mr. Lee spoke on the safety first question and said that it warrants a certain amount of money being spent in order that economical results might be obtained. There is a limit, however, beyond which it will not be worth while to spend money, as the results that can be obtained will not be commensurate with the cost. It is sometimes far better to turn to the improvement of the men than to the improvement of the physical features of the road. In other words, it is well to turn attention to man failures. In England, where human life is placed on probably a higher value than in any other country of the world, and where their cars are little better than wooden bandboxes, there has been no indication of a movement towards the compulsory use of the steel car, because they think more of discipline than they do of such helps to minimize the effects of an accident. We have gone further. There is a movement on foot to legislate expenses upon railroads that they cannot properly bear. The carelessness of automobile drivers, for example, causes one long continuous series of accidents at grade crossings, a series of accidents that spell carelessness on the part of the drivers of those machines and which would never happen if they would use ordinary care. Yet the state of New Jersey has enacted a law for the abolishing of grade crossings that puts the whole burden on the railroads. Yet to abolish the grade crossings in New Jersey on the Pennsylvania Railroad alone, would cost about $60,000,000. To abolish all the grade crossings on the whole Pennsylvania system would cost about $600,000,000 and to do the same for all of the crossings in the country would cost about $5,000,000,000. So that the cost of such provisions for safety becomes simply stupendous, while it could all be avoided by the exercise of common carefulness.

The same statement holds in the matter of trespassers. Here, again, it is simply a case of carelessness. Trespassers are killed and it is man or woman carelessness.

The Pennsylvania Railroad has spent immense sums for the promotion and securing of safety, but it must be evident that there are limits beyond which it will not pay to carry the expenditures. It is far better to cultivate the spirit of carefulness. Take the matter of the automatic stop, for instance. Suppose such a stop were available and could be used. It would simply be transferring the responsibility from the man on the engine who has the interest of his own life to make him careful, to the shoulders of another who has no such interest. Again, the self-cleaning ashpan that has been required by law. It has cost the Pennsylvania Railroad alone about $600,000, and all of this is an absolute waste and would not have been needed, if the men were careful.

In the matter of boiler construction the Interstate Commerce Commission contemplates the establishment of an arbitrary factor of safety. If this is done we will be the only country in the world where such a rule exists for other than state railroad. Such a rule, if made calling for a factor of safety of 5, would not add materially to the exemption of locomotive boilers from explosion Out of the 63,000 locomotive boilers in use in this country there have been but six shell explosions in two years, making an average of one shell explosion for each 21,000 boilers per annum, and this on a factor of safety of about 3¼. While on the Pennsylvania Railroad there has not been a single shell explosion since 1880. The whole question of boiler safety sifts itself down to one of carefulness and maintenance. Take the reports of the Travelers Boiler Insurance Co. Out of all of the money collected for insurance 25 per cent was spent in securing business; 50 per cent for inspection; 10 per cent for business expenses; 5 per cent for profit and 10 per cent for loss. So that out of all the money paid for steam boiler insurance, 90 per cent was unnecessary, and could have been saved by carefulness.

In short, it is a question of men. It points to the necessity of taking young men and training them so that they will appreciate the necessity of being careful; of showing them

that pure mechanical and mathematical formulae are not altogether reliable and dependable, but that back of their use there is need of experience and care, and this training is of the first importance if satisfactory results are to be obtained. The perfection of the man as well as of the machine is what we must work for.

The morning session on Tuesday was opened with addresses by S. G. Thomson, superintendent of motive power and rolling equipment of the Philadelphia & Reading, and Frank McManamy, chief of the boiler inspection department of the Interstate Commerce Commission.

MR. THOMSON'S ADDRESS

Mr. Thomson especially emphasized the value of and the assistance to be derived from the federal boiler inspectors. These men are all experienced and their duties, in taking them from one road to another, give them opportunities for observation that do not come to the average boilermaker. They are, therefore, possessed of a mass of information that they are quite ready to impart and which the members should take every opportunity to acquire. It behooves every boilermaker in the country to welcome these men to their shops and learn what they can from them. There can be no quarrel with the boiler inspection law if an attempt is made to comply with its provisions and get all out of it that is possible.

He also touched on the difficulty of getting good men to do the work and the scarcity of apprentices in the boiler shop. It is hard and noisy work and needs ample compensation, both physical and mental. The former must come through the wages received and the latter from the satisfaction of work well done.

MR. M'MANAMY'S ADDRESS

Mr. McManamy took exception to a statement that had been made by Mr. Lee to the effect that it was possible to spend too much money for the prevention of accidents, and insisted that resources could not be wasted in an attempt to secure greater safety. While many accidents might be due to man failure, and all boiler failures might be attributed to that cause, yet, if that were the case, then the application of the boiler inspection law had succeeded in reducing man failures by about 60 per cent in the fatalities due to boiler accidents in comparison with what had occurred before the law became effective. Thus for the first year of its operation and for the following nine months for which reports are available the reduction has been 48 per cent. If the application of the law has been responsible for the elimination of a single accident that caused a loss of life, it is well worth while.

All that the federal boiler inspectors ask is co-operation on the part of the boilermakers and others who are responsible for the operation of boilers on railroads. It must be remembered that the government does not supply the inspectors that are to do the everyday work of inspection. That is done by the employees of the railroads, who thus become the real government inspectors.

As for the factor of safety, the roads have been working under a factor of safety of 4 for some time, and the manner in which it is proposed to enforce a strict compliance with this factor will bring no hardship to any one. In the early inspection of boilers, it was found that there was a large number of them that had a very low factor. In fact, some were found whose factor was below two, and surely no boilermaker would advocate running a boiler in that condition. While there may be some difference of opinion as to what might be the best factor to employ, no one would hazard the opinion that 2 was correct to use. In the early inspection referred to it was found that there were:

212	boilers whose factor of safety was less than 2½
1,224	boilers whose factor of safety was less than 3
2,371	boilers whose factor of safety was less than 3¼
4,524	boilers whose factor of safety was less than 3½
7,254	boilers whose factor of safety was less than 3¾
12,043	boilers whose factor of safety was less than 4

A factor of safety of 4 is not too high and the reason for fixing it at that is that it is one to which builders have been working for a number of years. Nor will it be any hardship to comply with the provisions of the rulings, for the railroads will have seven years in which to bring their boilers up to the standard. No road can possibly be tied up because of it. As it stands the regulation gives all roads up to January 1, 1915, to bring their boilers up to a point where the lowest factor of safety will be 3; until January 1, 1916, to bring them up to a factor of safety of 3⅓; until January 1, 1917, to bring them to 3½; until January 1, 1919, to bring them to 3¾, and until January 1, 1921, to bring them up to 4. That is a fair sample of the manner in which the department is attempting to co-operate with the railroads.

It is quite natural for men to resist the application of rules of regulation whether they be good or bad, even though those regulations really make no difference in their conduct. But it has been found that no big interest serves the public to the best advantage when it is uncontrolled.

Of late we have heard a great deal about the safety first movement. It is nothing new, for it started about 22 years ago, when it was enacted that the railroads should equip their cars with automatic couplers and air brakes. At that time some roads were using these appliances of their own accord, but it was necessary that legislation should step in to compel those who were not inclined to introduce these now necessary parts of the equipment to do so. Surely no one now thinks that the compulsory use of these things is a hardship, nor would any railroad man think that it would be possible to run his road without them.

In the same manner there will be no hardship in the enforcement of the regulation regarding the factor of safety. The railroads are not to be asked to make changes in a day that will require time, and boilers will be allowed to run until they are sent to the shop for the application of the firebox and wrapper sheet. So, too, it will be found that these rules are not new but merely the application of old rules that are already fixed and in use. When the matter was under discussion, the roads were asked to file copies of their rules, and it was found that out of the 170 roads complying with the request, practically every one of them returned the rules that have been adopted by the Master Mechanics' Association, so that these have become the basis of the federal rules.

Turning back to the boiler inspection rules, the records show that in the first year there were 856 accidents, in the second there were 820, and in the first nine months of the third year there have been but 523.

All the federal authorities ask is that there shall be a close and hearty co-operation between them and the railroads and, for the most part, this has been freely given.

SECRETARY-TREASURER'S REPORT

The secretary's report showed that during the past year $1,211 was received for dues and from other sources; that there are 543 members, but that some of these are delinquents in the payment of dues, so that there are, today, 417 members in good standing. The treasurer reported a balance on hand of $647.67 after the payment of all outstanding bills to date.

OXY-ACETYLENE AND ELECTRIC WELDING

The committee on oxy-acetylene and electric welding reported that oxy-acetylene welding seems to be satisfactory in results and in general use. Cracks in firebox sheets of all kinds have been welded with the acetylene process and some very good results have been obtained.

One report shows that cracks 15 in. to 30 in. long have been welded and have given eighteen months' service without trouble; also half side sheets have been successfully welded. Much trouble has resulted, however, from sheets cracking adjacent to the welds, or in the welds themselves, due to the unequal stresses placed upon the sheet when cooling. For

reinforcing thin places in sheets such as at washout hole openings, the oxy-acetylene process is of value. The process is serviceable in heating sheets for laying up, in the fitting of boiler work; also in straightening crown sheets where they have been damaged by low water, as the heat can be localized and thus not injure adjacent sheets. It has been found dangerous to make welds adjacent to riveted seams and staybolts, as both are prone to leak after such treatment when the boiler is again placed in service.

Oxy-acetylene has been found extremely valuable in cutting boiler sheets, engine frames, etc., and in some cases is used preparatory to welding. For use in emergencies, such as on wrecking trains where time is a big factor, it has proved its worth as a cutting agent. In the salvage of broken parts of rolling equipment and of shop machinery considerable savings are reported.

Electric welding is past the experimental stage. One very important point is that it is not dangerous.

Electricity has been used to some extent for cutting, but its greatest value is in welding. Cutting is done with a carbon, using it in the holder the same as the iron rod is used for welding. This method of cutting is not fast, but it can be used in places which are difficult of access with a pneumatic hammer.

Side sheets, half side sheets and patches on firebox sheets are successfully applied, using the welder in joining the sheets just as in a butt joint. Experience has shown that the more crooked the seam the more efficient is the weld, that is, the sheets should be cut in an irregular outline so that the weld will not be in a straight line. The same holds true regarding patches.

From various papers received by the committee the opinion in regard to the manner in which sheets should be fitted to make a good weld seems to be general. The best results have been obtained by placing the sheets about 3/16 in. apart and beveling them from the fireside about the same as a sheet is beveled for caulking. This allows the metal to burn through into the water space, filling the opening entirely. The welded seam should not be more than 1/16 in. thicker than the sheet which is welded. Reinforcing the sheet with welding metal is poor practice.

The welding of broken mud rings makes a saving and is done by cutting away the firebox sheet with the fractured mud ring. All the broken parts should be removed to give ample room for the welding. The welding should be done by filling in the opening, welding the firebox sheet and ring together.

Door opening flanges are repaired by setting in a patch, or in many cases applying a collar completely around the opening. This class of repairs is of great value, as in many cases the door opening flanges give trouble, when the remainder of the firebox is in good condition. A large number of door opening patches and collars are reported to have given good service for the past two or thre years.

One of the most frequent questions asked in connection with electric welding is what success is obtained by welding over old seams that are damaged by fire, cracked sheets, and old patched seams also damaged. In most cases it is found that it is a very uncertain way of making repairs, as in many cases the weld fractures and continues to give trouble. There have been cases, however, where this kind of repairs have held fairly well. Very few cases of welded tube sheet bridges have given satisfactory service.

The best method in welding tubes in the tube sheet is to first apply the tube in the usual manner, viz., place a layer of metal around the caulking edge of the bead, being careful not to put it on too heavily, and hammer it while it is at a white heat. If proper care is taken in hammering this while at a white heat it will leave the metal smooth and will not require turning up. Tubes applied in this manner can be tightened in the sheet in case of leaks from the weld giving out by the ordinary method. In many cases the tubes have given double the mileage when welded in, and in all cases show a decided improvement.

Applying new ends to tubes by the electrical process is being experimented with at present and the results thus far obtained seem to be superior to those obtained by the former. The welding is very smooth and stands well under test. The miscellaneous uses of the electric welder are also numerous, such as repairs to shop machinery, etc.

The report was signed by Frank A. Griffin, chairman.

DISCUSSION

There was some confusion at first owing to misunderstandings regarding the methods to which the members referred. There was a mass of directly contradictory testimony as to the possibilities and the shop methods to be employed until it was required that each speaker should state whether he was talking of the electric or the oxy-acetylene method.

In the matter of the welding of tubes in the tube sheet, it developed that there had been considerable trouble with the tubes breaking just back of the weld, and in some cases small pieces had broken out, but had been welded in place again without removing the tube. This was especially apt to occur in bad water districts. The welding in of old tubes is not a profitable proceeding, and it is good practice not to weld in any tubes that are more than two or three years old. With new tubes no difficulty has been experienced. The usual method of applying tubes that are to be welded in place is to set them in the ordinary way and then cement them around the edges of the bead with the welder. The older method was to let the tube project through the sheet about ¾ in., and then weld it in place. Some tubes have been applied without the insertion of the copper ferrule, but there has been trouble with them and it has been necessary to roll and expand them with great frequency, so that it is always better to use the ferrule.

The application of patches brought out a good deal of discussion, especially as to the best method of holding the sheets while the welding was being done. Two methods were proposed; one was to fit the sheet and lay it loosely in place and then weld, after which the rivets attaching it to the foundation ring or other part were to be driven and the staybolts put in. The other was to drive the rivets and insert the staybolts before the welding was done. When the patch was loosely applied, it was found necessary to drop one end by an amount proportional to the length of the patch and allow it to draw up as the welding proceeded. It was here that the difference of experiences came out. Some stated that it was impossible to put the tight sheet in place, and others that it was unnecessary to do it loosely. It finally came out that with the oxy-acetylene process it was necessary to use a loose sheet, while with the electric weld the sheet could be riveted in place first.

In the application of patches it was found that the oval patch was much more easy to make a success of than the rectangular patch, and that the round patch was better still. Cases were cited where oblong patches measuring 18 in. by 44 in. had been in service for more than a year with satisfactory results.

As for the welding of cracks a number of speakers stated that they had no success in welding cracks that were more than 12 in. long. Also it must not be expected that the welded crack will last as long or give as good service as the original sheet, and this holds especially where the patch is rectangular. The last side welded has to carry the greatest stress and is most likely to give way, and this is especially true where the weld is made with oxy-acetylene because of the greater heat developed and given out to the sheet and the consequent greater contraction of the welded part.

In the electric welder it was urged that a higher voltage than that usually employed should be used. In one case the first machine worked on a voltage of 250, the second had 500 and it is expected that the third will use 1,500 with greatly improved results.

Firedoors are welded in complete without the use of any rivets. This is done by simply laying the sheets in place and

welding along one edge of the lip of one of them. In this way a tight joint is obtained and one that does not require any calking. In some cases patches were made with a corrugation to take up the expansion with very satisfactory results. The welding of button head stays has been done so successfully that old worn stays have been made as strong as new stays.

Finally it was recommended that for welding the electric process worked the best, while for cutting the oxy-acetylene was much the better.

THE CHEMICAL TREATING OF FEED WATER

T. F. Powers, Chicago & North Western, reported in part as follows on this subject:

Feed water can be treated successfully, if systematized methods are adopted and wonderful results can be obtained, but otherwise it is a waste of money.

The cost of maintaining treating plants will, of course, vary according to the price of chemicals used, which are generally lime and soda-ash, these being the cheapest. There is no additional cost of labor, as the pumper can attend to the plant with his other duties.

Where treating plants are not installed, good results can be obtained by putting soda-ash into the tanks of locomotives. The amount per thousand gallons should be determined by the chemist, after an analysis has been made of the water; but in either case, the method of using must be systematic and the blow off cocks on locomotives used regularly. Blow off cocks should be so applied that they can be operated from either side of the cab by the enginemen without getting off the seat box.

One of the reasons soda ash has been condemned by some railroads is because the claim is made that it causes locomotives to foam and that it cuts out valves and packing. This is true if blow off cocks are not used. Soda ash is put into boiler to soften the scale or turn it into a sludge or soft mud. This should be removed through the blow off cocks. Their use will prevent foaming and tend to keep the boilers clean and extend the time between washouts, as it is the opinion of the writer that it is a detriment to the boiler to cool it down and that the longer the washout period can be extended, the better it is for the boiler. With the use of water from treating plants, or using soda ash direct into the tanks of locomotives, the washout period can be extended and the changing of water, in most cases, is unnecessary, provided the blow off cocks are used.

On the Chicago & North Western the locomotives are fitted with a blow off cock on each side, on the outside sheets near the front corner of the mud ring. Our instructions relative to the use of blow off cocks are to blow the engine into blow off tanks when leaving the roundhouse and to use the blow off cocks every few miles on the road, or at least once between every two stations. This is followed closely by the road foreman and master mechanics. The blow off cocks are also used on the arrival at the roundhouse. When blowing off on the road, the blow off cock is only opened from three to five seconds. This does not mean a great loss of water, as practically all that comes out in that time is mud. A good demonstration of this is to open the blow off cock on an engine that has no steam on, but with the water still hot. All that comes out of the cock for the first few seconds is mud, then clear water, showing that it is in the first few seconds that the mud is cleaned out. Another proof is to open a blow off cock against a snow bank or fence; it will be spotted in one place only.

On one 150 mile division of the Chicago & North Western using treated water, a few years ago it was necessary to either change water or wash the boiler at each end of the road. Now with the same water, engines are making 1,050 to 1,500 miles between washouts and are having no trouble on account of foaming. When plugs are removed there is not over 2 in. of mud on the mud ring. This improvement has been accomplished by systematic use of the blow off cocks, as described above.

Summing up the benefits derived from treating water with soda ash and lime in treating plants or putting soda ash direct into tanks when the blow off cocks are used, they are:

Failures from foaming are practically unknown; washout period is extended; changing of water is not necessary; better circulation is obtained, making better steaming engines; boilers are kept clean, and burnt and buckled side sheets are very rare; leaky tubes and side sheets are avoided; engines are run longer between shopping for tubes because scale is softened and removed by the blow off cocks in the form of mud; there is a decrease in the expense of upkeep in roundhouse, and a better feeling among men running engines, because engines are not failing on the road due to leaking and foaming.

H. W. Armshaw, Canadian Pacific, made the following report:

During the past 24 years the western lines of the Canadian Pacific have experimented with many different methods of water treatment. The chemicals used were principally lime, soda ash and caustic soda, and although all of them mixed with the water in various ways before entering the boiler, only one of them took care of the sludge.

This method consisted of agitating and settling chamber tanks, with means for removing sludge before the water entered the boiler. This was very satisfactory at times, and prevented heavy scale formation, providing sufficient caustic soda was used to take care of the majority of the sulphate of lime and magnesia, but when treated sufficiently to do this, the engines foamed so badly that we were obliged to resort to round trip washouts. When the quantity of caustic soda was reduced to alleviate foaming, a hard flinty scale developed around the tubes at the back tube sheet end and rosettes and stockings of scale accumulated around the staybolts, together with a formation of it on the firebox plates.

The life of tubes and firebox plates was lengthened over what was obtained with crude water, or with any other class of treatment, although it was not determined whether it was more profitable to renew the tubes and fireboxes at intervals to prevent boiler failures or treat the water as described.

During the past 18 months on the Saskatchewan division and for about one year on the Manitoba division, the treating of water by this means has been discontinued and a polarized metallic preparation substituted. The results of the application are, that it is possible to keep the boilers clean with sufficient and proper washing out, to run between general repairs without the removal of any tubes and without failures because of leakage. In no case has it necessitated more frequent washing out than with other methods of treatment. It has in all cases permitted 100 per cent more mileage between washouts and in many cases it is possible to run 200 per cent. So far as we have been able to discover, pitting or corrosion does not follow application of this treatment. It does not aggravate foaming. Its action on the removal of old scale and new formation appears to be more mechanical than chemical in that it does not create a pasty sludge next to the fire plates and tubes, which is common with other treatments and which prevents the water getting into proper contact with the plates, being most difficult to wash off, thus producing overheating of the plates and tubes, which frequently results in boiler failures.

By correctly regulating the period between washouts, with a strict observance of the best practices, accompanied by good water pressure, it is possible to do better than we have previously, inasmuch as the reduction in boiler maintenance and washing out expense has been greatly reduced, together with economy in water consumption, rubber hose, boots, etc., and less general wear and tear on the tool equipment for boiler washing and boilermaking. There is also a large saving in coal and lighting up material because of boilers being hot, due to less washing out, and also an increased earning power of the locomotive because it is available any time without boiler-washing or boilermaker's work.

Taking into consideration the many advantages, I feel quite satisfied in saying that it is more profitable from a mechanical standpoint than any other treatment experimented with during my experience. It is very conveniently applied after each washout, being distributed in bars over the crown and tubes, or arranged to suit what the inspection indicates to be the proper place to locate it, according to the condition and design of the boiler.

It is too early in our experience to say what percentage of saving is effected in boiler maintenance and boiler repairs because it takes several years to arrive at an intelligent estimate of its use compared with what was formerly obtained. However, my experience with it so far demonstrates that it is a great money saver.

DISCUSSION

The discussion was very meager and centered around the methods employed in the handling of the boiler where water treatment was used. The main thing that was insisted upon where soda ash is used is that the blow off cocks should be used with great frequency. On one road there is a blow off cock on each side of the engine that can be operated from cab and the men are obliged to use them either one for each mile run or at least once between stations. Where this rule has been observed there has not been a single case of a burned side sheet, and all difficulties with foaming has disappeared.

Some experience was cited with the different kinds of boiler compounds, but their success hinged to a great extent on the systematic use of the blow off. Polarized mercury came in for a good part of the discussion, and there was a difference of opinion as to its continued efficiency. In one case it was found that it cleaned the boiler of old scale and for a time thereafter seemed to work all right, when hard scale formed and it did not do as well as soda ash. In another case it had supplanted a series of water treating stations that extended over a whole bad water division, to the great saving of expense for the railroad. It does not attack the brass work and greatly reduces roundhouse expenses. In short, it has saved many thousands of dollars, besides doubling and trebling the mileage between washouts.

But when all is said, the success of any compound depends upon its applicability to the particular water that is used.

FLEXIBLE STAYBOLTS IN PLACE OF SLING STAYS

It was merely brought out that there is no advantage in their use insofar as the prevention of the cracking of the flange of the tube sheet is concerned, as the relief of the bending stresses to which that part is subjected does not seem to have any appreciable effect. The reason why they are used in that place is that they are so easy to apply.

COMBUSTION CHAMBERS IN LARGE LOCOMOTIVES

The committee reported that but few railroad companies are using boilers with a combustion chamber to any great extent. The Chicago, Milwaukee & St. Paul has 605 locomotives equipped with combustion chambers. These are of the Mallet, Mikado, Pacific and Prairie types, and are equipped with arch brick tubes.

The first of this class, a Prairie type freight engine, was put in service in 1907, which gives nearly seven years' experience, and should be ample time to demonstrate the benefits derived from a combustion chamber boiler or any weak points or faulty construction. The depth of these combustion chambers is from 32 in. in the Prairie type to 76 in. in the Mallet.

The Prairie type engines have tubes 13 ft. 4 in. long and 2 in. in diameter; the Pacific type tubes are 19 ft. long and 2 in. in diameter; the mikado type tubes are 17 ft. 7 in. long and 2 in. in diameter, and those of the Mallet type are 24 ft. long and 2¼ in. in diameter.

The Prairie type engines have service records of more than 185,000 miles between tube settings, the Pacific type more than 196,000 miles, the mikado type more than 90,000 miles, and the Mallet type more than 86,000 miles.

There are 195 of the Prairie type, and during the past seven years these engines have been in service over most of the system. While a great many of them are in bad water districts, the tube records show over three years' service from the majority of the engines, and in many cases 50, 60 and 70 months' service. Twelve of these engines are still in service with the original tubes now having 60 months' service. In this class no new fireboxes have been applied except where damaged by low water. A number of side sheets, door sheets and back tube sheets have been applied, but only two inside throat sheets and one combustion chamber.

There has been but little trouble due to seams leaking. In some cases where there was trouble with seams leaking on top of the inside throat it was found necessary to scarf the sheet down and apply new rivets or bolts, but where this work had been done originally in a proper manner, the seams did not give much trouble on account of leaking.

The only trouble discovered at all was broken braces from the bottom of the combustion chamber to the bottom of the shell. It is believed that the cause is temperature strain.

The Pacific type engines are giving good service, the firebox sheets standing up well. A few side sheets and a number of back tube sheets have been applied. Over 36 months' service with one setting of tubes is being obtained and with but very little trouble on account of tubes leaking.

A few of the disadvantages of combustion chamber are increased cost of construction; breaking of throat stays; difficulty of removing broken staybolts from the bottom of the combustion chamber; the occasional leaking of seams on the inside throat sheets; the necessity of cleaning out the combustion chamber occasionally due to not keeping the bottom tubes open.

To offset this there are the following advantages: A good free steaming engine due to better circulation and more effective heating surface; less caulking of tubes, longer service as shown by the record, and less cold air striking the tubes; each renewal cost of tubes less on account of shorter tubes; increased life of back tube sheet due to less tube work; decreased cost of renewal of back tube sheet on account of smaller sheet, less labor to apply, no staybolts, no arch tubes, no mud ring; increased life of arch brick on account of not having to knock out the arch when renewing or working the tubes; due to increased combustion space above the fire, the combustion of the coal is improved and the smoke nuisance is greatly reduced; a combustion chamber boiler has a shorter flue, making a saving on the original cost. Fewer tubes are applied, making another saving, and a better tube sheet is obtained, due to wider bridges and better spacing, and therefore a better circulation.

The report was signed by A. N. Lucas, P. F. Gallagher and R. A. Pearson.

DISCUSSION

One of the advantages of the combustion chamber is that the tube sheet is very much more easily applied than in the case of the ordinary construction. Staybolts break in them, especially in the first row from the tube sheet, but this can be obviated by the use of the flexible bolt. It was also found that where the air pump was placed over the bolts they broke and when it was removed the breakage ceased. In oil burning service it is well to protect the seams with seam brick, and this can be obtained of any shapes to cover any part of the chamber that it is desired to protect. Tube failures are very much less with the combustion chamber than without it and there are records of a life of from 150,000 to 200,000 miles. There has been some trouble with the wings on the inside of the chamber, but this was attributed to the quality of the coal that was used and the fact that the seams were not protected with seam brick.

RADIAL STAYS IN THE CROWN SHEETS OF OIL BURNING LOCOMOTIVES

The committee reported that the screw crown bolt and radial stay, with a taper of ¾ in. in 1½ in. riveted over on the fire side of the sheets, give the best service. Where crown bars are used an extra heavy wrought iron pipe thimble should be used between the sheet and the crown bar. When radial stays are used they should be riveted over in the same manner as when crown bolts are used. Some roads are using a taper nut on the bottom end of radial stays over the crown sheet on coal burning engines. This is also thought to be beneficial on oil burning engines. The report was signed by C. L. Hempel, chairman.

EFFECT OF THE METHOD OF FLUE CLEANING ON SCALING

The committee on this subject reported that if the flues are properly cleaned in a rattler, by a dry process, or are run in water, they will not scale up more readily than new flues. Experience indicates that when flues are properly cleaned in the rattler there is no material difference in the mileage obtained, nor in the amount of scale.

There are certain makes or designs of flue cleaners of the rotary type, which leave small crevices in the body of the flue, causing the scale to accumulate very rapidly, and flues cleaned in this manner accumulate the scale more rapidly, and accumulate a greater amount of scale, in the same length of time, than when they are new or cleaned by the rattling process. This kind of a machine does not clean the interior of the flue, which is very detrimental to it. The new or rattled flues are thoroughly clean on the inside.

This system of cleaning flues with a rattler does not cause them to scale after the application to the boiler, if they are thoroughly cleaned and the exterior left in a smooth condition.

Rough and improperly cleaned tubes cleaned by methods which leave the exterior rough and uncleaned and crevices in the body of the flue, will undoubtedly scale more readily in the boiler than new or smoothly cleaned ones.

The rolling of dirty tubes in a dry rattler, or in water rattlers, or on the chains of an ordinary rattler, seems to be the best form of cleaning, as it not only gives a smooth polished surface on the outside, but loosens and cleans out all the dirt from the interior of the flue. If the flues are properly cleaned in the above mentioned manner they will not scale any more rapidly than new ones, when the same kind of waters are used in the boilers. After all, the amount of scale accumulating on the flues depends almost entirely upon the amount of impurities or chemical properties contained in the water used.

If the flues are cleaned properly on the outside surface with a flue rattler either by the dry process or in the water and the replaced or pieced flues are free from scale and as smooth surface as that obtained with a new flue, the thickness of the body of the flue does not create a condition which accelerates scale formation, although becoming thinner with age. Further, members of the committee have never been able to obtain more flue mileage from a new flue than a rattled one, if the flues are cleaned properly.

The report was signed by B. F. Sarver, H. R. Mitchell and M. J. Guiry.

DISCUSSION

The discussion strayed off into the method of rattling and was very brief. It was suggested that many of the troubles due to rattling were due to carelessness in the doing of the work where the rattlers were neglected and the tubes were allowed to remain in them for a long time so that they were dented or cracked. Where the work is properly done, the tubes are rattled until they are clean and no longer, and then they are taken out and separated at once into lots representing scrap tubes, those that are to be cut and those that are in good condition. No appreciable difference could be detected in the adherence of the scale due to the method of cleaning the tubes.

As for the cleaning of the inside of tubes of oil burning locomotives there is no difficulty about that, as the regular sanding accomplishes all that is needed. It was recommended that wet rattling be used and that the speed of the rattler be made from 15 to 20 revolutions per minute.

WEDNESDAY'S PROCEEDINGS

On Wednesday, May 27, the members visited the plants of the Parkesburg Iron Company at Parkesburg, Pa., and the Lukens Iron & Steel Company at Coatesville, Pa.

THURSDAY'S PROCEEDINGS

At the opening of the last session on Thursday morning, May 28, Henry J. Hartley, superintendent of the boiler department of the Wm. Cramp & Sons Ship & Engine Building Company, delivered an address. He spoke first regarding the great developments that have taken place during the past few years in the size and duties of steam boilers, especially those that are used for marine purposes, and then spoke of the importance of hydraulic rivetting as bearing on the efficiency of boilers. He considered it the most important part of a boiler. Defects of design and even of materials may be corrected by careful and skillful workmanship, but when there is a defect in the rivetting it holds until the boiler is in service and then it will manifest itself without fail. Defective rivetting is exceedingly difficult for the inspector to detect and it is only when leakages in service occur that the trouble is seen. The fundamental principle of good rivetting is that the rivets shall completely fill the holes and the fact that they did not fill the holes is the reason why there was so much difficulty with hand rivetting. Weaknesses can often be traced to this because, then, the stress on the rivet is increased and there is apt to be a movement of the plate or the rivet that results in shearing or leaking. It has been found that it is well to have the total area of the rivet sections somewhat more than the net section of the plate.

Again, as the rivet is upset on the point end first, and thus fills the hole at that point it is well to have a fillet at the head end so that, in the driving, the rivet will have a tendency to fill the hole at that point also and thus make a water tight rivet. In heating, it is well to heat the head to a bright cherry red and the point to a dull cherry red. This gives the rivet a tendency to upset more readily under the head and when the machine comes down on the point the result is that the whole hole is filled.

It has been found by careful experiment that for a ⅝ in. rivet the static pressure for driving should be about 25 tons; for a ¾ in. rivet about 33 tons; for a ⅞ in. rivet, 50 tons; for a 1 in. rivet, 66 tons; for a 1⅛ in. rivet, 75 tons, and for a 1¼ in. rivet, 100 tons. When these pressures are reduced to the pressure per square inch of section it will be found to be about 161,000 lb. for a ⅝ in. rivet; 150,000 lb. for a ¾ in. rivet; 166,000 lb. for ⅞ in. rivets; 165,000 lb. for 1 in. rivets; 150,000 lb. for 1⅛ in. rivets; 166,000 lb. for 1¼ in. rivets; the average of the whole being about 163,000 lb. per square inch of section.

John M. Lukens who was to have delivered an address at this time was prevented from so doing by illness and a telegram of sympathy was ordered sent to him.

The report of the committee on topics for the next convention was referred to the executive committee.

ELECTION OF OFFICERS

The following officers were elected for the ensuing year: President, James T. Johnston, foreman boiler maker, Santa Fe System; first vice-president, Andrew Greene, general foreman boiler maker, Cleveland, Cincinnati, Chicago & St. Louis; second vice-president, D. A. Lucas, general foreman boiler maker, Chicago, Burlington & Quincy; third vice-president, John B. Tate, foreman boiler maker, Pennsylvania Railroad; fourth vice-president, Charles P. Patrick, foreman boiler maker, Erie Railroad; fifth vice-president, Thomas Lewis, foreman boiler maker, Lehigh

Valley; secretary, Harry D. Vought; treasurer, Frank Gray, foreman boiler maker, Chicago & Alton. Members of the executive board: J. Winterstein, foreman boiler maker, Philadelphia & Reading; Harry Weldin, foreman boiler maker, Pennsylvania Railroad; Thomas Powers, foreman boiler maker, Chicago & North Western.

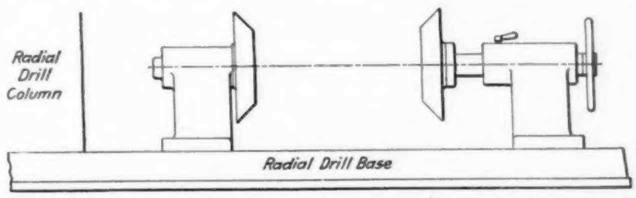
The Boiler Makers Supply Men's Association elected the following officers: President, J. C. Campbell, Chicago Pneumatic Tool Company; vice-president, D. J. Champion, Champion Rivet Company; secretary and treasurer, Geo. Slate, The Boiler Maker, New York.

DRILLING THE SMOKEBOX FLANGES OF LOCOMOTIVE CYLINDERS

BY ERNEST W. SLINGSBY

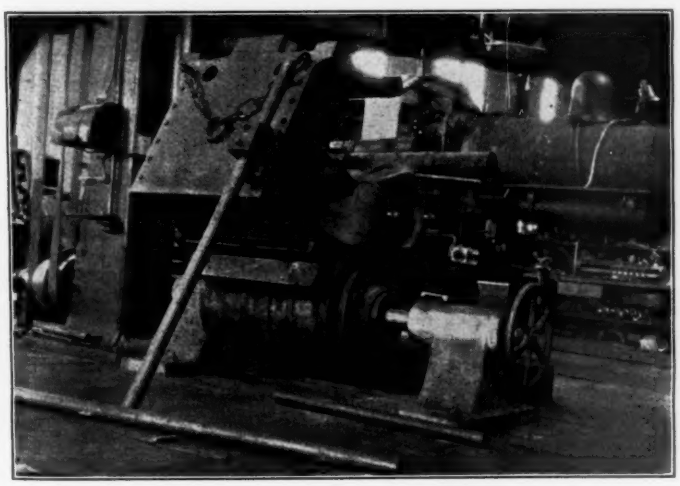
In the accompanying line drawing is shown a device for facilitating the boring of bolt holes in the smokebox flanges of locomotive cylinders. It provides a means whereby the angle of the smokebox flange may be readily changed so that the drilling may be done on a radial drill.

Two heavy cast iron brackets are rigidly bolted to the base



Device for Holding Cylinders While Drilling Smoke Box Flanges

of a radial drill, the arm of which has vertical adjustment. One of the brackets is fitted with a lead screw and clamp such as is used in the tailstock of a lathe. Each bracket is fitted with a large cast iron cone. The cones have a common horizontal axis about which they are free to revolve. The distance between them can be varied by means of the lead screw. As shown in the illustration, the cylinder is clamped and held in correct alinement between the cast iron cones, and in this position is free to revolve about the axis of its bore. The smokebox flange can then be held at any angle desired by means of an adjustable bar bolted to the center facing.



Cylinder in Position for Drilling Smoke Box Flange

Before this device was installed it was necessary to drill the smokebox flange holes with a pneumatic drill.

TAR FROM COAL.—In Great Britain about 1,325,000 tons of tar are annually produced by the destructive distillation of coal, from which about 10,000,000 gal. of benzol are recovered.

APPRENTICE MATERIAL

BY A. B. KERR
Instructor of Apprentices, St. Louis & San Francisco, Springfield, Mo.

The old adage, "Be sure you are right and then go ahead" is of more importance today than when it was first spoken, because there are now so many more ways of starting anything. History and experience have so convincingly proved this truth that it is modern practice to eliminate, so far as possible, all chance of failure from any venture or organization.

The selection of the material is the first consideration when an organization is planned, a building proposed or an engine designed. The material is subjected to tests to determine its strength and capacity. Consider the shop of a railroad as a delicate and complex machine. The mechanical appliances such as lathes and planers are supposedly the best of their kind; it is then the men who make the shop efficient or otherwise. As each part of a mechanical device is carefully selected and tested, so should each man be chosen so far as is possible.

If a shop is using material that is full of flaws, it cannot turn out a serviceable finished product. One of the greatest faults of the apprentice system of today is that the "material" is not inspected closely enough; this is the reason the finished product is often of a low standard. While most railways have a certain standard of examination for prospects, yet little or no inquiry is made as to the applicant's character, his morals, his circumstances and his real reasons for entering the apprenticeship. Several concerns maintain bureaus whose specific function it is to supply the different shop departments with systematically selected men.

The recruiting of workmen in the shop is not given the consideration it should have. To obtain men of good character, men who have been trained in the practice of their crafts and who are good mechanics should be the purpose of every employment officer. The company would then have a machine that would produce the best results.

The apprentice system of providing material from which to develop skilled mechanics is much better than the helper plan; industrial instruction increases the ability and capacity of the man, and an efficient man is developed quicker. But in order to obtain worthy boys to take up the trades, they must be shown an inducement. Make the apprentice system so attractive that it will draw desirable material to itself; make the system stand on its own merits. Advertise to all the employees that the system offers an excellent opportunity to their sons; advertise also over all the territory covered by the road. Comprehensive pamphlets describing and illustrating the apprentice work may be distributed to advantage in a manner similar to that followed by the traffic department, taking into account the different fields. The selection of apprentices is a business matter. Yet few roads, if any, openly solicit apprentice material; they choose rather to make a selection from whatever applicants may present themselves.

Boys of good quality must be sought just as any other material of good quality. Some may drift to the shop and apply, but there are many boys of the right kind who have never considered such an action, generally because they do not know the conditions. To them and to their parents the railroad is an employer to be shunned; they think of the work as laborious and dirty, with close confinement, exacting discipline, harsh foremen and small pay.

The officer to whom the prospective apprentice presents himself should be a good judge of boys, in addition to being a close student of human nature. Judging men is different from judging boys. Endeavor to put the boy at his ease and then lead him to talk of himself; of his home; of his friends and his associates; be very much interested; be congenial and sympathetic. Learn the character of the boy; that is the point of vital importance, for it is on this foundation that good mechanics must

be built. Study his morals; a boy of poor morals will not make a much better machinist than he would a preacher. Endeavor to discover what he is naturally fitted for; if a boy's father is a boilermaker and makes more money than a painter, that is no reason why the boy may not be better fitted to be a painter.

Remember that a boy is naturally an individual, but as a boy he has not yet learned those subterfuges practiced by the man in search of employment. If the boy's mind can be put entirely at ease he will appear natural, not as a man, but as a boy, and while talking with him, if possible, form your opinion. If the applicant is a hopeless case, do not lead him on; dismiss him, but advise him. If, however, further investigation is necessary, put the boy to work in the shop as a laborer or helper where he can be watched and perhaps coached. If he seems desirable and you have a vacancy, do not immediately sign him up as an apprentice, but place him in the shops for several weeks as a helper; if after that time he proves fitted to the work, enter him on the apprentice roll.

There are some who reason that this is an undue amount of attention to give to the selection of apprentices, but if it is systematically arranged, all applicants go to the one officer, and if this one man did nothing else but provide the average road with first class apprentices in the mechanical department, a great saving would be effected and efficiency increased. These boys will be the future journeymen, but the very method of selecting them has its good effect on the present mechanics. Surely it is contrary to human nature for a body of men not to help a movement that is directed toward the express improvement and the uplift of those in their ranks.

It is very unsatisfactory to be continually disciplining by laying a boy off and by other such forms of punishment. Also, it is still more unsatisfactory to be of necessity dismissing boys during their first six months. Such procedure is demoralizing to the system. When a boy is put at his trade care should be taken to see that he is a pretty safe venture. As the president of a large railway once remarked, "Any fool can fire a man, but it takes a good man to hire one." It is indeed poor practice to fill a vacancy with the first boy who presents himself; far better let the vacancy exist until such time as the desirable boy is found. If the right boy does not apply for the job, hunt him up.

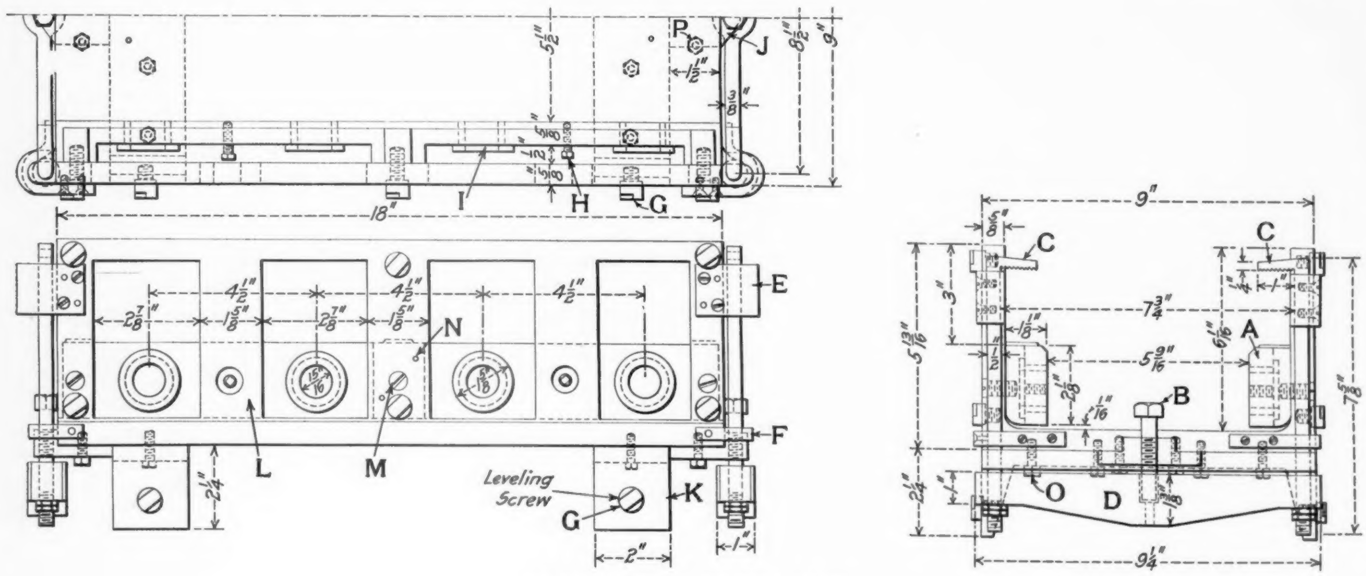
To sum up, maintain a good and thorough apprentice system, make this system of itself attract desirable apprentice applicants, and finally, carefully select from these applicants the ones best fitted to fill such vacancies as may exist. So far as is possible, put the right boy in the right place and then the apprentice system will be a great source of satisfaction to all concerned.

JIG FOR DRILLING CROSSHEAD SHOES

BY T. F. EATON
Tool Room Foreman, Baltimore & Ohio, Baltimore, Md.

In order to make all crossheads and crosshead shoes of each class interchangeable, so that parts for renewal may be sent out on the line completely finished, a special jig for drilling the shoes was designed by the writer. This jig assures accurate work when used on a drill table which is in good condition.

The construction is simple and inexpensive so far as material is concerned. It was made from two pieces of ¾ in. by 5 in. by 6 in. angle, each 18 in. long. These angles, which are shown at *L* in the illustration, were machined all over with a 4 in. end mill on a large milling machine. They are held together by means of two cast iron cross bars and machine screws *O*; the cross bars are shown at *K*. On each side of the jig are eight hardened tool steel leveling screws *G*, which were ground on a surface grinder after being applied to the jig. Two leveling bars *A* were made from machine steel and each held in place by three screws *M*, together with three of the leveling screws. After securing the leveling bars to the jig, it was placed on a milling machine and the jig holes drilled by using the micrometer attachment. Accuracy in locating the holes was thus obtained. Four hardened and ground tool steel bushings *J* were then pressed into the holes in each bar. Perfect alinement of the bars after removing for renewal of the bushings is insured by the dowel pins *N*.



Jig for Drilling Crosshead Shoes.

The four clamps *C* were made from tool steel turned to ½ in. diameter and bent at right angles on one end. Teeth were milled on these clamps and they were hardened and tempered where they grip the crosshead shoe. Each clamp is held firmly to the body by one wide bracket *E*, at the top and one narrow bracket *F*, at the bottom. The clamps are threaded on the lower end and those on each end of the jig pass through a pulling bar *D*, which is held in place by nuts on the lower ends of the clamps. The pulling bar is made from machine steel, finished all over. A boss through the center is counterbored and fitted with a tool steel bushing which receives the end of the tension screw *B*. The tension screw is held in place by the bracket *J*, which is secured to the body by two ½ in. cap screws, *P*.

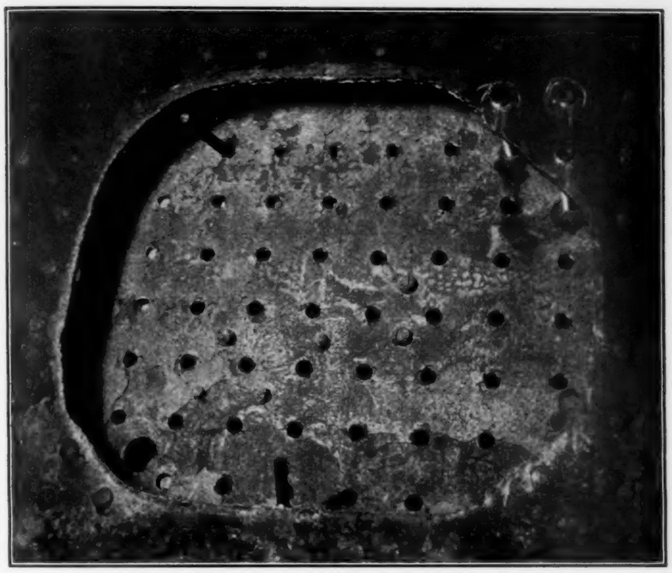
Brackets *E* and *F* are made from sheet steel bent over a ½ in. mandrel and fastened to the body by ¼ in. machine screws and No. 3 dowel pins.

To place a crosshead shoe in the jig the clamps *C* must be turned outward. The shoe is then inserted and the clamps are brought back and adjusted by tension screw *B*. After the shoe

is firmly held the two set screws *H*, which are sharply pointed, are screwed up lightly, preventing the shoe from slipping when the drill strikes sand or blow holes.

ELECTRIC WELDING AT THE ANGUS SHOPS OF THE CANADIAN PACIFIC

Electric welding, in conjunction with the oxy-acetylene cutting torch, is being very successfully used at the Angus shops of the Canadian Pacific at Montreal. The oxy-acetylene method is

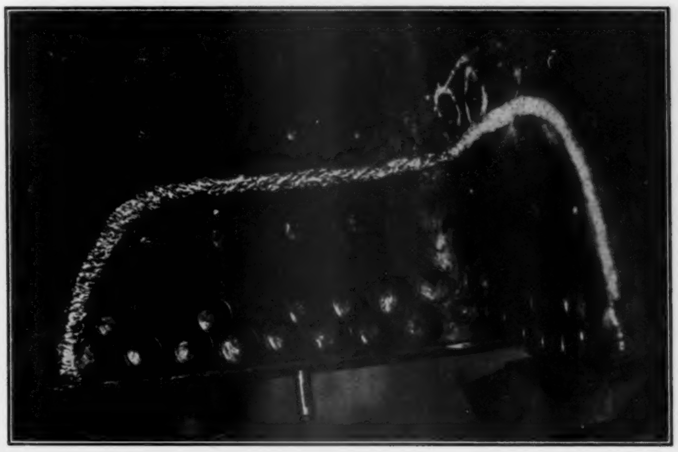


Firebox Sheet After a Defective Piece Has Been Cut Out by the Oxy-Acetylene Torch Preparatory to Patching by Electric Welding

also being employed for filling in flat spots in tires with considerable success.

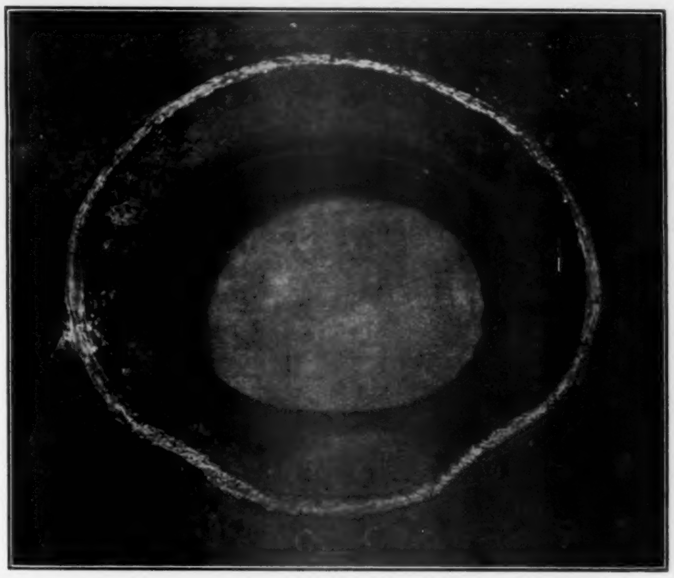
The illustrations show examples of some of the electric welding in fireboxes and also the various stages in the welding of a broken pedestal on a Pacific type locomotive without removing the frame. The accompanying table also gives the cost of doing this work and the cost under the old method. Similar figures are also given for repairing the fire door which is illustrated; while the broken frame could have been welded in place by oil or other means, such methods have not been found sufficiently satisfactory on the Canadian Pacific. The fire door hole had been in service a year when the photograph was taken. The alternative method in this case would have been to renew the entire sheet instead of resorting to patch bolting.

There are two welding sets in use in the Angus shops, the voltage employed being about 70. In firebox patching, the necessary piece is cut out with the oxy-acetylene torch and the edge of the sheet V'd. The old staybolts are knocked out and a



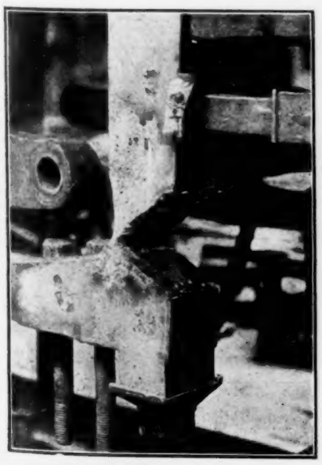
Piece Welded in the Corner of a Firebox

patch is laid out using as a pattern the piece removed from the firebox. This also has the edges V'd and is placed in position

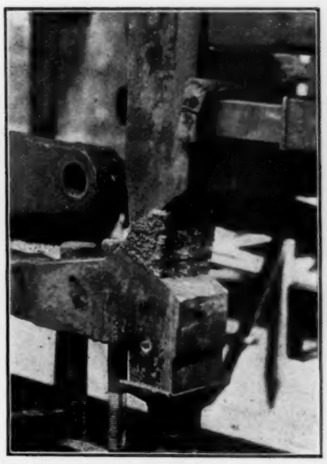


A Fire Door Hole Patch Welded in by Electricity

and held by temporary staybolts while being welded. As the heat with the electric system is localized, no trouble is experi-



Broken Pedestal V'd out for Electric Welding



The Pedestal Weld Partly Completed

The Completed Weld

The Welded Pedestal After Being Faced Off

enced from expansion. The weld is left slightly raised about the surface of the sheet and rounded.

In renewing fireboxes complete the old one is cut out with the oxy-acetylene torch. Instead of cutting out the seam rivets the torch cuts the seam alongside the line of rivets, avoiding the necessity of drilling the rivets through the heads and punching them out. A firebox can be cut out by means of the torch in four hours.

In filling in flat spots on driving wheel tires the surfaces are first slightly roughened and then filled in by oxy-acetylene welding, using tire turnings. The surface is then chipped and filed to a template of tire contour. A similar method is used to fill in holes that are worn oval in rods and motion work.

Comparison Between Expense Incurred in Making Repairs with the Oxy-acetylene Torch and Electric Welding and Methods Employed Previously

Defect	Present Method	Alternative Method
Cracks in firebox back sheet.	Cut out defective firehole and sleeve with oxy-acetylene torch, bevel sheet to 45 deg. with air hammer and electrically weld in new firehole, patch and sleeve; also weld short cracks in the sheet.	Remove back sheet and firehole sleeve complete and replace with new ones.
	Cost—Labor ....$23.64 Material 4.61	Cost—Labor ...... $98.58 Material 25.88
	Total $28.25	Total $124.46
Broken jaw in cast steel main frame.	Cut out wedge piece in location of break, chip faces, clean with air hammer and fill up cavity by electric welding with iron wire.	Remove frame from engine and transfer it to blacksmith shop; weld frame and remove to machine shop for machine work; return to erecting shop, replace and bolt up on engine, using new bolts.
	Cost—Labor ....$3.85 Material 5.01	Cost—Labor ....$28.08 Material 17.90
	Total $8.86	Total $45.98
Flat spots on driving tires; size from 4 in. to 7½ in. long.	Build up flat spot with oxy-acetylene torch, using tire turnings; dress up true to radius with chisel and file. Average cost per tire, $2.50.	Remove tire from engine, turn in lathe and replace. (This price includes metal lost in turning.) Average cost per tire, $12.50.

DEPTH OF CUT FOR TURNING DRIVING WHEEL TIRES

BY PAUL R. DUFFEY

In order to determine the depth of cut to be taken in turning a set of driving wheel tires, it is necessary to know the amount of flange wear. The wear being known, the depths of the cuts for various amounts of flange wear have been found from observation to be practically as given in the following table:

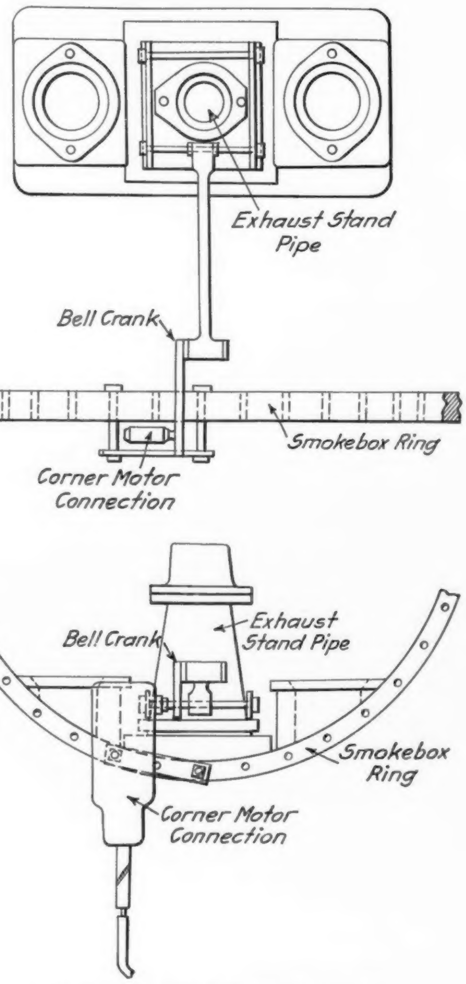
Flange wear, inches.	Depth of cut to true to gage, inches.	Reduction in diameter, inches.
1/32	1/16	1/8
1/16	1/8	1/4
3/32	3/16	3/8
1/8	1/4	1/2
5/32	5/16	5/8
3/16	11/32	11/16
7/32	3/8	3/4
1/4	7/16	7/8
9/32	1/2	1
5/16	17/32	1 1/16
11/32	9/16	1 1/8
3/8	5/8	1 1/4
13/32	21/32	1 5/16
7/16	11/16	1 3/8
15/32	3/4	1 1/2
1/2	25/32	1 9/16

These figures will be found useful by operators in setting the tools for a cut, as practically the figures given will prove the correct ratio between tread and flange unless hard or scaly spots are encountered, or excessive hollow wear.

GRINDING EXHAUST NOZZLES

BY H. C. SPICER
Gang Foreman, Atlantic Coast Line, Waycross, Ga.

In the accompnying illustration is shown an arrangement employed at the Waycross shops of the Atlantic Coast Line for grinding the joint between the bottom of the exhaust pipe and the cylinder saddle. This method has greatly reduced the time required to perform this work and also appears to produce a better joint. It consists of attaching a corner air motor to the smoke box ring by means of a strap iron clamp and connecting to it a small crank. The crank in use has a throw of 1½ in. The exhaust pipe is secured in a frame arranged for the connection of the rod reaching from the crank on the air motor.



Method of Grinding Exhaust Nozzles

The method of operation needs no explanation. It will be seen that the apparatus is very light, it is easy to attach and costs very little to make.

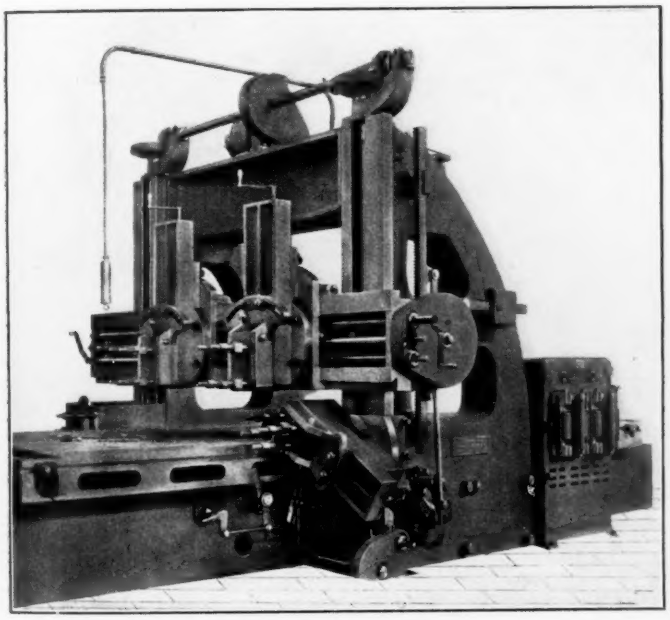
South African Railway Strike.—A bill introduced in the house of assembly in Cape Town, South Africa, making special provision for the railwaymen who remained faithful during the recent strike, and also for dealing with the railwaymen who struck, grants the loyal men four days' special leave on full pay, and the railway men who served with the defense force three extra days, also extra pay for specially meritorious service. The strikers who returned to work in accordance with the notices of January 16 and 22 will be fined one and a half day's pay respectively for every day on which they were absent from duty. Strikers who offered their services after January 23 will be re-engaged on condition that they are employed as new hands.

New Devices

PLANER FOR HEAVY WORK

Heavy planers taking work 120 in. wide by 72 in. high, 96 in. wide by 72 in. high, and 86 in. wide by 48 in. high, all of them to plane 18 ft. long, each constructed with two heads on the cross rail and one side head on each upright, have recently been built for the Commonwealth Steel Company, St. Louis, at the Pond Works of the Niles-Bement-Pond Company. These planers are constructed for heavy duty on steel castings, requiring a construction of great rigidity.

The illustration shows an 86 in. by 48 in. by 18 ft. planer which is used in machining open hearth cast steel combined double body bolsters and platforms. It is also used in machining steel truck frames and one-piece tender underframes. All of these



Planer for Heavy Work

castings require extensive machining to assure accuracy of alinement of the attached parts.

The planer is 88 in. wide between uprights, takes 50 in. between the table and the crossrail and planes 18 ft. long, the table being 80 in. wide and 20 ft. long over all. The planer is driven by a 50 h. p. reversing motor directly connected to the gearing. The speed of the table is adjustable without stopping, by hand wheels conveniently located on the controller, between the limits of 25 ft. and 50 ft. per minute for the cutting stroke, and between 50 ft. and 90 ft. per minute for the return stroke. The driving motor is directly connected to the first driving shaft at the back of the planer, out of the way of the operator. The controller, resistance, pilot switch and circuit breaker are mounted in a ventilated cabinet which also contains all wiring except the wires from the controller to the motor. These are carried across the planer bed in a metal conduit.

Operating levers on the front and back of the bed are connected to the reversing switch. These may be operated by hand or automatically by adjustable dogs on the table. At the instant of reversal the motor is automatically disconnected from the line and becomes a powerful dynamic brake, stopping the table at once without taking current from the line.

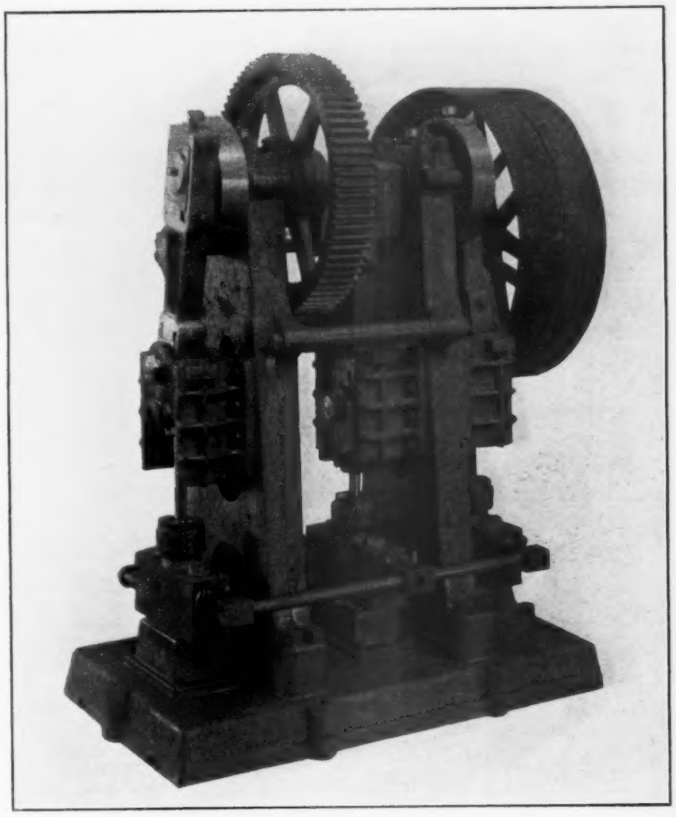
A patented pendent switch carried by a swiveling bracket mounted on the arch may be moved by the operator to any convenient position, and gives him control of the driving motor for starting, stopping or reversing the table, if the work requires him to be in such location that he cannot reach the levers on the front or back sides of the bed.

To prevent the table from running off the gearing should the line current fail, or the breakage of either tools or planer from overload, a patent circuit breaker is provided which will stop the motor at once, by dynamic braking.

The crossrail is raised and lowered by an independent reversible motor mounted on the arch.

TRIPLEX HYDRAULIC PUMP

The accompanying illustration shows a vertical type of single acting, triplex hydraulic pump recently brought out by the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio. This pump is made in three series of sizes; one of these has a stroke of 8 in., and is equipped with plungers 7/8 in. to 3 1/4 in. in diameter; the second has a stroke of 12 in. and plungers 1 in. to 4 1/2 in. in diameter; while the third has a stroke of 12 in., and plungers 1 1/4 in. to 5 in. in diameter. A range of pressure capacity from 600 lb. to 16,000 lb. per square inch is obtainable, depending on the size of the piston. The drive may be either by belt or electric motor. The pumps are fitted with screw



Single Acting Triplex Hydraulic Pump

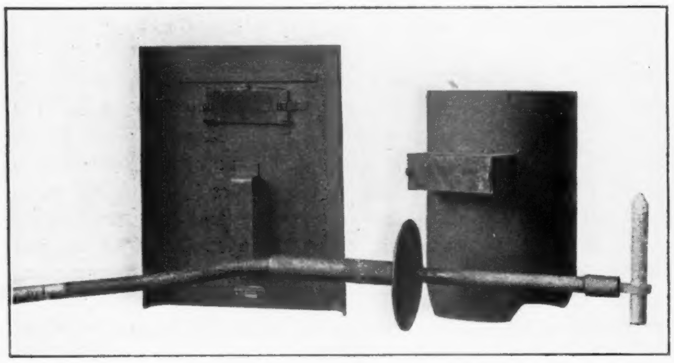
glands working against followers when equipped for high pressure work, or with stud glands when equipped with large pistons for low pressure work. The pistons are packed with compression packing. Forged steel is used in the construction of the high pressure pump cylinders and crank shafts.

When the pump is operated by a belt it has a single reduction of gears for the first size, and a double reduction for the other

two. The pulleys can be arranged to drive from either end. When a motor is used it has a double reduction of gears for all sizes. The first reduction has a ratio of 5 to 1, while the second reduction depends on the speed of the motor used. The height of the first mentioned size is 5 ft. 9 in.; the second 8 ft. 1½ in., and the third 8 ft. 10 in.

ARC WELDING

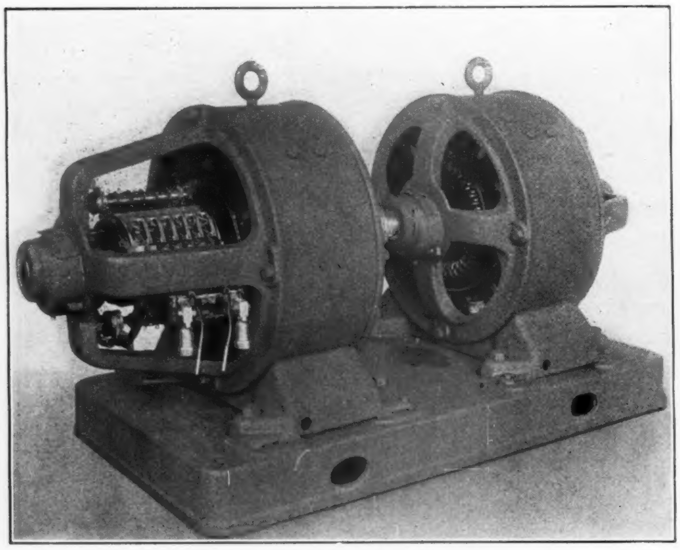
The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a standard line of electric arc welding equipments. These are simple in construction and easy to operate. Complicated relay methods for automatically inserting resistances are eliminated. Protection is



Shield, Hood and Carbon Holder

secured by circuit-breakers and special arrangement of the resistance.

The outfits are made complete in 200, 300, 500 and 800 ampere sizes. Each equipment includes a welding generator, or a welding motor-generator set, switchboard, control and all necessary accessories. The welding generator consists of a special 75-volt, commutating-pole, direct-current machine,



Motor-Generator Set for Arc Welding

either belt or motor-driven. The instrument and control panels are composed of two sections. The upper section contains the indicating instruments, protective apparatus and switches arranged for regulating the welding current, and the lower section contains the starting and protective equipment for the motor-generator set. As it is sometimes desired to have several welding circuits connected to one generator, a control panel is provided for each circuit. Each panel can be located at the most desirable place. Metal or carbon pencil welding can be done from any of these panels, independent of all others, and one or more arcs can be operated simultaneously. The accessories consist of a carbon holder and a hood for protecting the operator, together with a shield and a metal pencil holder for each welding circuit.

This equipment is the result of eight years' experience in

Surface Built Up on a Truck Casting

the shops of the Westinghouse Electric & Manufacturing Company, and has been employed on all classes of commercial work.

BRONZE BEARING METAL FOR TRUCK JOURNALS

A bronze bearing metal composed of 65 per cent copper, 30 per cent lead and 5 per cent tin, has recently been tested by the Baltimore & Ohio. A 22 lb. brass, used without babbitt was placed under the tender of a Pacific type locomotive. After the engine had run 51,000 miles an examination of the bearing was made. It was said to have been worn 1/32 in., and had made this mileage without running hot at any time. Other bearings on the tender were said to have been re-babbitted six times each.

For mill purposes, this bronze, which is treated in crucibles, may be hardened into what are claimed to be very superior mill brasses. A test of this nature is reported with two 75 lb. mill brasses used under the rolling table of a 108 in. plate mill, the minimum weight of which is estimated at 10,000 lb. It is stated that the two brasses gave continuous service for four weeks, or twice as long as the ordinary phosphor bronze. On account of the position of the bearings it was impossible to lubricate them during the test. It is stated that the graphite in the lead acts as a lubricant thereby effecting a reduction in the amount of oil used.

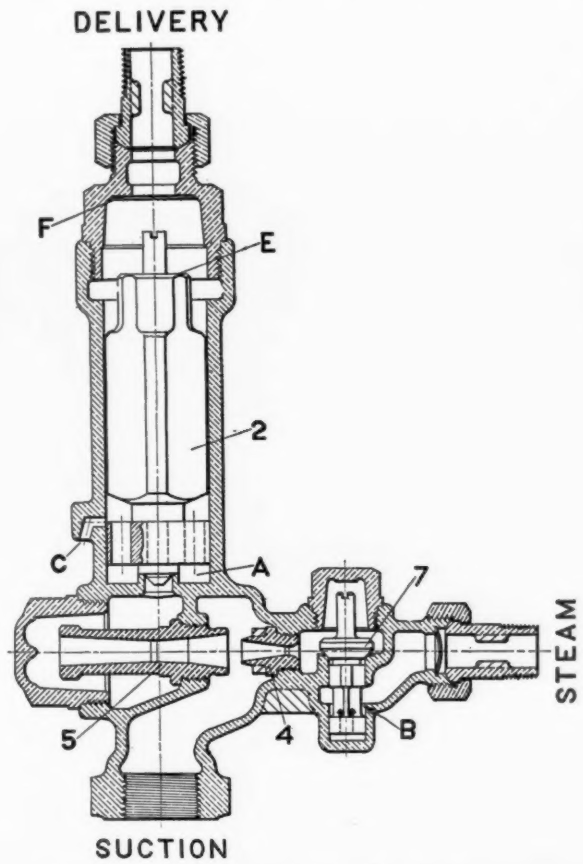
This metal is the product of the American Metal Company, Pittsburgh, Pa.

March Movement of Anthracite.—Shipments of anthracite coal during March were 255,515 tons more than in March, 1913, in spite of the light demand for coal. They amounted to 5,164,703 tons, as against 4,909,288 the previous year. The amount of coal on hand at tidewater shipping ports increased 109,307 tons, from 523,682 tons on February 28 to 632,989 tons on March 31.

HANCOCK COAL SPRINKLER

A sprinkler manufactured by the Hancock Inspirator Company, New York, for wetting down the coal on locomotives, was described in the Railway Age Gazette, Mechanical Edition, June, 1913, page 334, and an improved form in the issue of September, 1913, page 510. A further development of this device, superseding the other two forms, has recently been brought out.

This sprinkler acts on the principle of an ejector. The principal feature is a valve which automatically discriminates between steam and water and whose action prevents any sudden and unexpected discharge of steam through the hose. The device is generally applied on the strainer or on the suction pipe of the injector by the use of a short connecting nipple having a bend so that the sprinkler will be in a vertical position. A valve is placed in the steam pipe at a point where it can be conveniently reached.



Section Through Improved Hancock Coal Sprinkler

In operating the coal sprinkler, the steam valve in the pipe is opened wide, which action opens valve *7*. This also closes the drip hole *B*, the piston end on the lower end of the guiding stem covering the hole. Steam will now flow through nozzle *4* forming a jet and combining with water in tube *5*. There will not, however, be a flow of steam in starting, as tubes *4* and *5* are always under water because of the location of the sprinkler at a point lower than the tank.

Steam flows into the pressure chamber *A* and valve *2* is raised. Port *C* is also closed and the water is forced through the delivery pipe to the hose.

Should the flow of water be interrupted or the injector refuse to work, valve *2*, which discriminates between steam and water, will close the sprinkler so that no steam escapes to the hose. The steam, under these conditions, flows into the pressure chamber *A* and forces valve *2* upward. The end *E* of valve *2* seats against the surface *F*, thus making it impossible for steam to flow to the delivery tube. When not operating, both valves will seat. The valve *2* is heavy enough to prevent water flowing up the delivery pipe, and all the water in the delivery pipe will flow out of the drain hole *C*. At the same time the steam valve *7* will seat, preventing water from flowing up the steam pipe and all water or steam in the latter will drain out at the hole *B*. The sprinkler uses comparatively cold water, no steam can escape, and it is self-draining.

OXY-ACETYLENE WELDING APPLIED TO MANUFACTURING

A good example of the increased efficiency and generally decreased cost of manufacture effected by welding sheet steel articles as compared with drilling and riveting is shown in the steel truck made by the Standard Improved Truck Company, Chicago.

The warehouse truck which is shown in the illustration was formerly made by drilling and riveting all joints. Welding by the Oxweld process was proposed and a test truck made by this method. Results of the tests made to determine the relative strength of welded joints compared with riveted joints were so conclusively in favor of the welded joints that the welding process was immediately adopted.

Welding has not only produced a truck of greatly increased strength and rigidity, but has increased the output per man about 20 per cent with a saving of more than 30 per cent over the previous cost of manufacture.

The following is a summary of the report of the tests referred to, which were made by the Bureau of Inspection, Tests and Construction of Robert W. Hunt & Company, engineers. Three connections were submitted, each consisting of a portion of stringer tube and cross tube secured together by one of the following types of joints: connection *A* welded by oxy-acetylene torch; connection *B* riveted with two ¼ in. diameter rivets in double shear, one in the stringer and one in the cross tube through a plug and bushing inserted in the cross tube; and connection *C* riveted with ¼ in. rivet in double shear through the


Truck with Oxy-Acetylene Welded Joints

cross tube and 1/4 in. riveted reduction of inserted plug through the stringer tube, the head being in tension.

The three connections were subjected to tests under identical conditions. In each case the stringer tube was supported as a beam at points close to and on either side of the cross tube. The joint was then destroyed by tension in the cross tube.

Connection *A* failed at the weld under a maximum load of 25,460 lb. Under a load of 17,090 lb. the cross tube, on which the tension was applied, commenced to scale, indicating that the elastic limit of the steel in tension had been reached.

Connection *B* failed by shearing the rivets in the stringer tube under a maximum load of 4,740 lb.

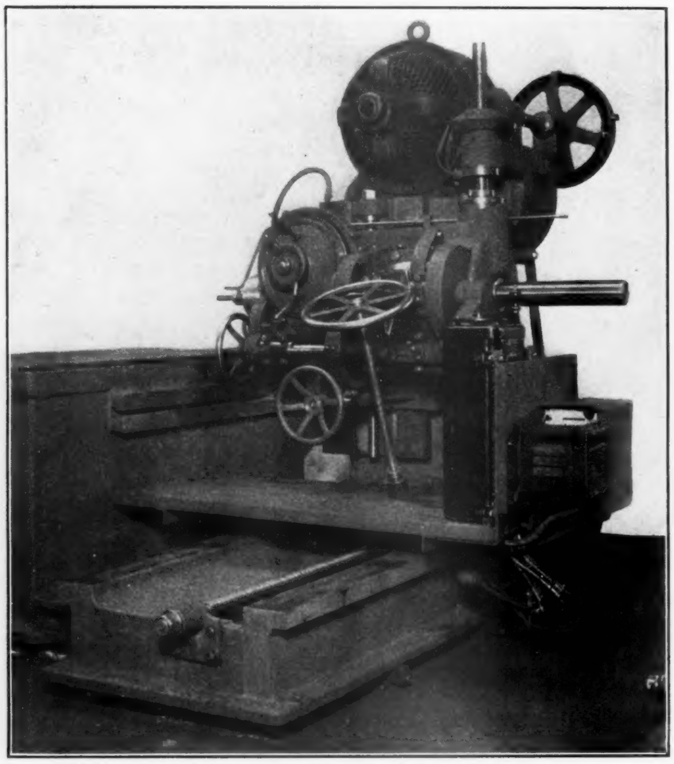
Connection *C* failed under a maximum load of 5,800 lb. by shearing off the rivet in the cross tube and pulling through the rivet connection in the stringer tube.

HORIZONTAL DRILLING MACHINE

A horizontal drilling machine designed for heavy work with high speed drills in hard material has recently been brought out by the Detrick & Harvey Machine Company, Baltimore, Md.

The general design is similar to that of a horizontal boring and drilling machine of the traversing column type, having a fixed work table, a column traversing horizontally on the runway and a saddle traveling vertically on the column.

The spindle is of hammered high carbon steel with a tapered front bearing 7 7/8 in. in diameter running in a phosphor bronze bushing, with adjustment for taking up wear. It has a dust proof roller thrust bearing and is provided with a standard taper socket hole. The spindle is driven by a 20 h. p. 4 to 1 variable speed motor, mounted on the top of the column. All driving gears are of cast steel or manganese bronze, while the pinions are of high carbon steel. No belts or chains are used on the drive or feeds. The spindle speeds range from 60 to 240 r. p. m.



High Speed Horizontal Drilling Machine for Heavy Work

The power feed is driven from the spindle sleeve gear and has all steel gears and clutches with a steel pinion engaging in a rack which is cut from the solid on the steel feed quill. There are four changes of feed ranging from .004 to .09.

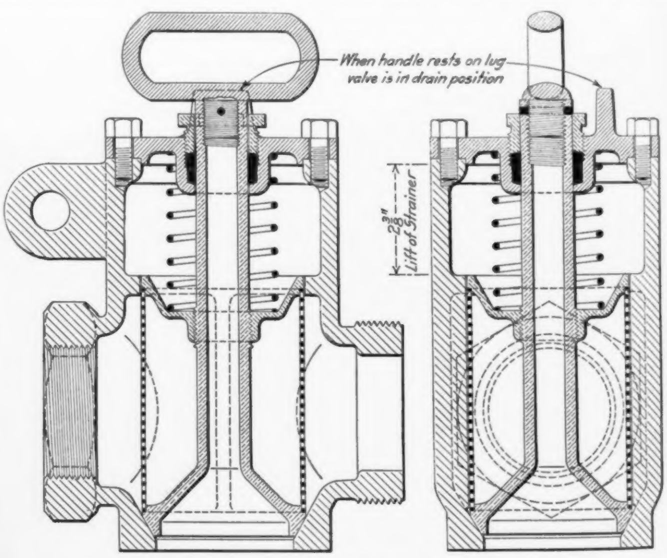
The vertical movement of the saddle and the horizontal movement of the column are obtained through hand wheels conveniently located at the operator's platform; the column is mounted on rollers to reduce friction on the runway. Both the saddle and the column may be changed to any required position, and have gibs for taking up wear.

The controller for the motor is also mounted on the operator's platform. An oil jet is provided for the drill and is fed from a rotary pump driven by a small auxiliary motor. The work table is provided with a gutter around all four sides by means of which the oil is returned to the supply tank of the pump. All gears are completely covered.

As shown in the illustration, the machine has a high box work table permitting the spindle to be brought down within 3 in. of it. A vertical adjustment of 12 in. and a horizontal adjustment of 6 ft. are obtainable.

STRAINER AND DRAIN VALVE

The purpose of the Watters strainer and drain valve shown in the engraving is to avoid the difficulties resulting from injector failures due to the clogging of the suction pipe with coal and other foreign matter, and also to provide an efficient and simple means of cleaning the pipe or tank in freezing weather without disconnecting or taking anything apart. When the injector fails or for other reasons it is desired to clean out the pipe, the valve which carries the strainer is lifted and an opening is provided which is sufficient to permit the dirt to wash out quickly. When used as a drain the valve is lifted and the handle allowed to rest on the lug shown on the top of the cover. In this position an opening of about 1/4 in. is provided which takes care of any leakage. It is claimed that this feature entirely eliminates trouble from frozen pipes in cold weather. When it is desired to empty the tank it is only necessary to lift the valve to its full opening. This device can be installed in any part of the pipe line between the tank and the injector, but should preferably be placed at the lowest point. Where it is convenient, the lifting handle can be extended up through the cab or tender floor by an extension of the valve stem. In a closed position the valve is held on its seat by its own weight and a spring. This valve is manufactured by the Railway Supply & Equipment Company, Candler building, Atlanta, Ga.



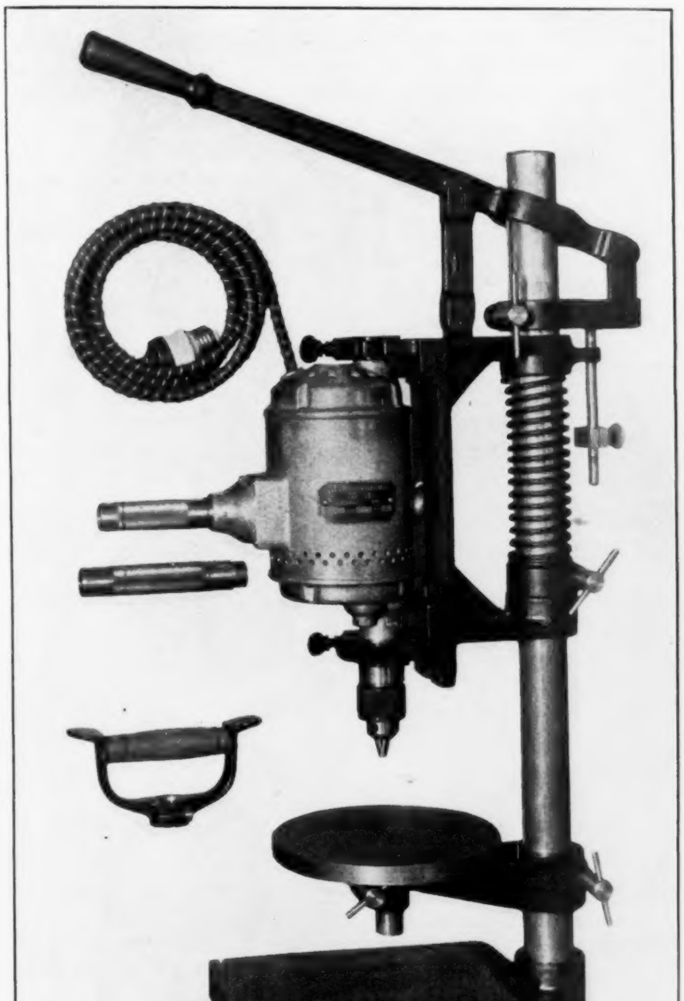
Strainer and Drain Valve for Injector Suction Pipes

WIRELESS TELEGRAPHY.—A wireless triumph was achieved on February 11, when the New Sayville, Long Island, wireless station succeeded in establishing communication with Nauen, near Berlin, a distance of over 4,000 miles.

INTERESTING ADAPTATION OF ELECTRIC HAND DRILL

The combination portable electric hand drill and sensitive drilling stand, which is shown in the illustration, has recently been developed by The Cincinnati Electrical Tool Company, Cincinnati, Ohio. The electric hand drill may be detached from the bracket and used independently. This operation is a simple one, requiring only the adjustment of the two thumb nuts, which release the hinged caps that lock it in the bracket.

The bracket which carries the drill may be adjusted in any position on the column by means of the clamping screws. When clamped in position it has a vertical adjustment, or feed, of 3 in., which is controlled by the hand lever. A stop on the column regulates the depth of the holes to be drilled. The drilling stand has been designed to receive electric hand drills of ¼ in., ⅜ in. and ½ in. capacity and weighs 60 lb. The table is 8 in. in diameter and may be adjusted to any height on the column; if it is desired it may be swung to one side out of the way. The distance from the column to the center of the table is 5 in. The column is 30 in. high and 1¾ in. in diameter, and the base measures 9 in. by 11 in.



Combination Portable Electric Hand Drill and Sensitive Drilling Stand

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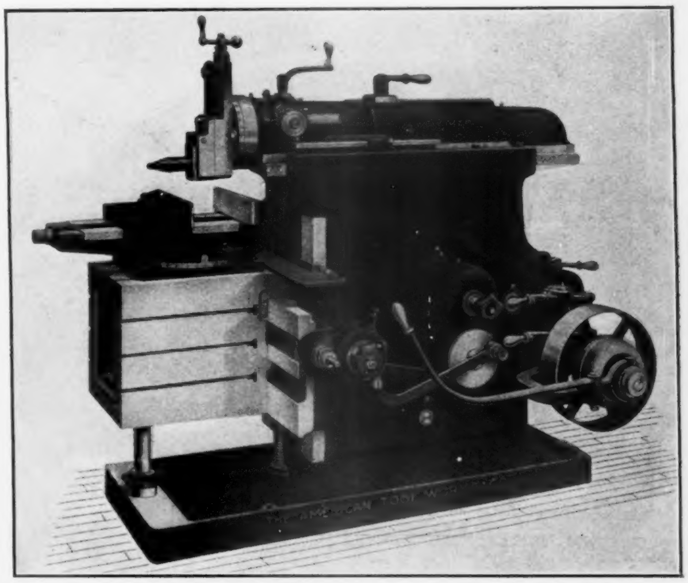
TRIAL OF THE TRIPLEX LOCOMOTIVE.—The triplex compound for the Erie was recently tried out on the Baltimore & Ohio.

HEAVY SERVICE SHAPER

A new design of heavy service shaper has been brought out by the American Tool Works Company, Cincinnati, Ohio. One of the first points considered when laying out this machine was that of power input. The approximate power a shaper of this kind would require for performing the heaviest classes of work was determined, then sufficient extra power added to provide a safe working margin; consequently, this machine, when doing the average heavy work, should not be constantly working up to the limit of its capacity. The cone steps are large in diameter and wide of face, being arranged to accommodate a 3 in. belt. The countershaft speeds are high and the back gear ratios are higher than usual on standard shapers of this size.

A range of eight strokes from 6½ to 90 per minute has been provided, this range being in geometrical progression and calculated to give the best results on all classes of work. It was found that a slower speed than 6½ is unnecessary and a speed faster than 90 impracticable on account of the excess of vibration caused by the rapid stroke. The length of the stroke may be easily changed at will without stopping the machine.

The ram and rocker arm are of an improved design which provides a rigid construction. The rocker arm is rigidly connected to a pivot shaft at the bottom of the column which supports all the weight of the arm and other parts, thus relieving the ram from any dead weight and eliminating undue vibration. The connection between the rocker arm and the ram is by means of a double link which is so arranged that it pulls down on the ram during the cutting stroke, thus tending to neutralize the upward thrust of the tool. A reduction in wear of the ram bearings is effected by relieving the ram of the weight of the rocker arm.



Shaper Designed for Heavy Work

One of the features most essential to the life and accuracy of any shaper is an effective means for taking up the wear. The continuous taper gib used on this shaper provides a means by which a full length bearing can be maintained and the rate of wear kept down to a minimum.

The cross feed is of a new design for which a number of advantages are claimed. It is both automatic and variable, providing a range of graduated feeds, 32 in number. These can be changed and accurately set while the machine is running by means of a conveniently located knurled knob. The feed is thrown in or out and reversed by a knob on the feed

plunger. The plunger engages either one of two holes in opposite sides of the swinging gear on the bonnet. Whether the feed takes place at the beginning or at the end of the stroke depends upon which hole is engaged by the plunger.

The connection between the feed mechanism and cross-feed screw is made by means of an adjustable fiber friction. This forms an automatic safety feature which will protect the feed works from damage should the tool accidentally be fed into the cut or the apron be fed into either end of the cross rail.

The head is operative at any angle within an arc of 100 deg. The down slide is fitted with a continuous taper gib having end screw adjustment for taking up the wear. The down feed is of unusual length and is provided with a graduated collar on the feed screw reading to .001 in. A large tool post for using inserted bits is supplied.

The table support is of a new design. It consists of a notched bar supplied with an adjustable nut at the bottom and is operative throughout the full traverse of the rail. The notches are spaced 1 in. apart and are engaged by a spring plunger after the rail has been properly adjusted, any further adjustment necessary being accomplished through the nut at the bottom of the notched bar, which bears on the planed surface of the base.

The rocker arm is made double section at the top, which in connection with the large opening through the column permits a shaft 4 in. in diameter to pass under the ram for keyseating. Larger shafts may be keyseated by setting over the table to allow shaft to pass outside of the column, using the head set on an angle.

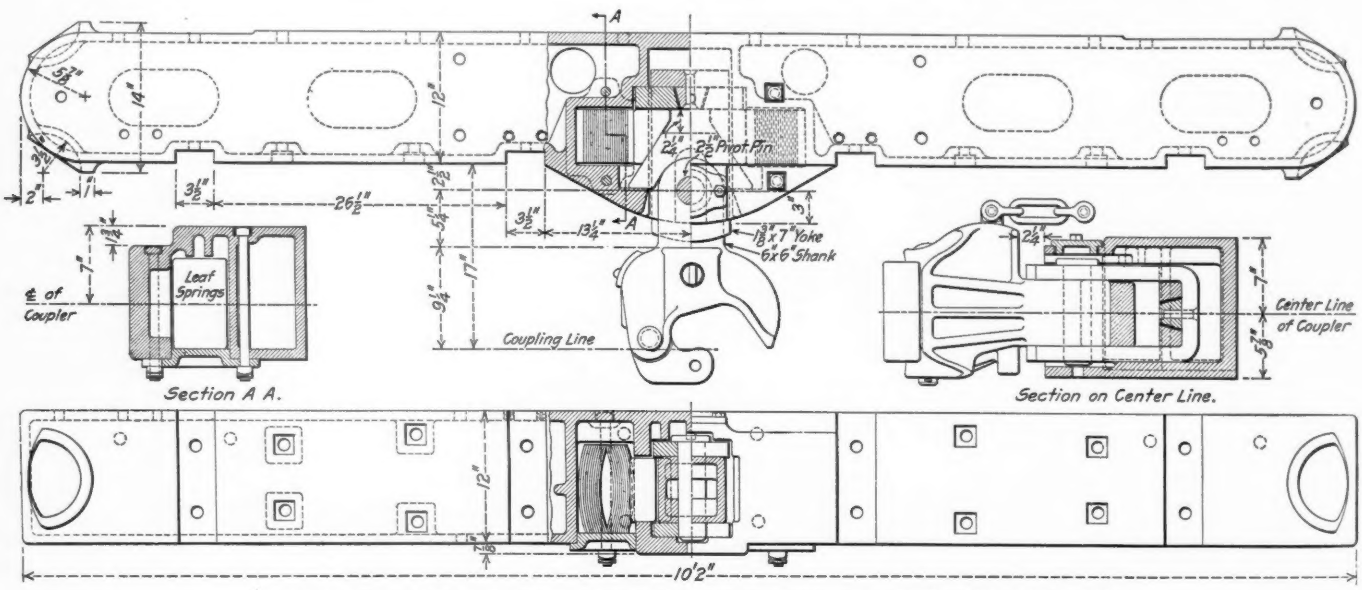
Special attention has been paid to the thorough lubrication of all working parts. A system of reservoirs is provided from which oil is distributed to the various bearings by means of felt wipers, thus doing away with a multiplicity of oil holes.

A speed box has been designed for this machine which is a complete unit and readily interchangeable with the cone pulley drive at any time. The speed box is provided with heat treated steel gears, the teeth of which are machine rounded to facilitate meshing. The shafts are liberally proportioned and are given a large center bearing in the case, which materially increases their rigidity. There are no loose running parts, each gear being keyed to its shaft. Speed changes can be made while the machine is running. In addition to a gravity system for lubricating speed box journals the case has been made oil tight, thus permitting the transmission to run in oil.

A lever extending well to the front of the machine controls a large diameter friction incorporated in the driving pulley. Acting in unison with the friction clutch is a friction brake located on the opposite side of the box, which stops the ram instantly when the friction clutch is thrown out.

CAST STEEL BUMPER WITH FRICTION DRAFT AND BUFFING GEAR

There is shown in the illustration an arrangement of friction draft and buffing gear with a short pivoted coupler incorporated in a cast steel locomotive bumper beam. This arrangement has been developed by the Gould Coupler Company, Depew, N. Y., and with it the capacity of the draft and buffing gear can be reduced below the maximum capacity if desired. This is accomplished by removing some of the plate springs and inserting in their place shims or plates to take up the slack. The plate springs are removed or replaced through a pocket in the bottom and when in position they are retained by a cap bolted over the pocket. The short coupler shank engages with the front wedge and in buffing this wedge is carried backward by the coupler shank and forces out the two side wedges, which are held from movement toward the rear by the back follower abutting shoulders in the buffer casting. In a pulling movement the front wedge shoulders against the forward portion of the buffer casting and the rear follower is pulled forward by the yoke which moves the side or rear wedges forward against the front wedge and the resistance is obtained from the plate springs. All of the parts, with the exception of the plate springs, are inserted through the opening for the coupler shank and the yoke in the front portion of the casting. It is claimed that this arrangement of friction gear and buffer is entirely satisfactory in operation and has given efficient service. The capacity can be varied from 100,000 lb. to 160,000 lb.



Arrangement of Cast Steel Bumper with Friction Draft and Buffing Gear Included

Rope Railway in India.—A rope railway, 75 miles in length, is to be put in operation in India. It will connect the rich country in the vale of Kashmir with the plains of the Punjab over the Himalayas. The line, it is claimed, will be the longest in the world, the present longest being 22 miles and situated in Argentina. Sections will be 5 miles long, and most of the spans will be 2,400 ft. The steel towers, some of which will be 100 ft. high, will be braced, and double 1½ in. cables, 9 ft. apart, will carry the steel cars. The carrying capacity of these cars will be about 400 lb.—*The Engineer.*

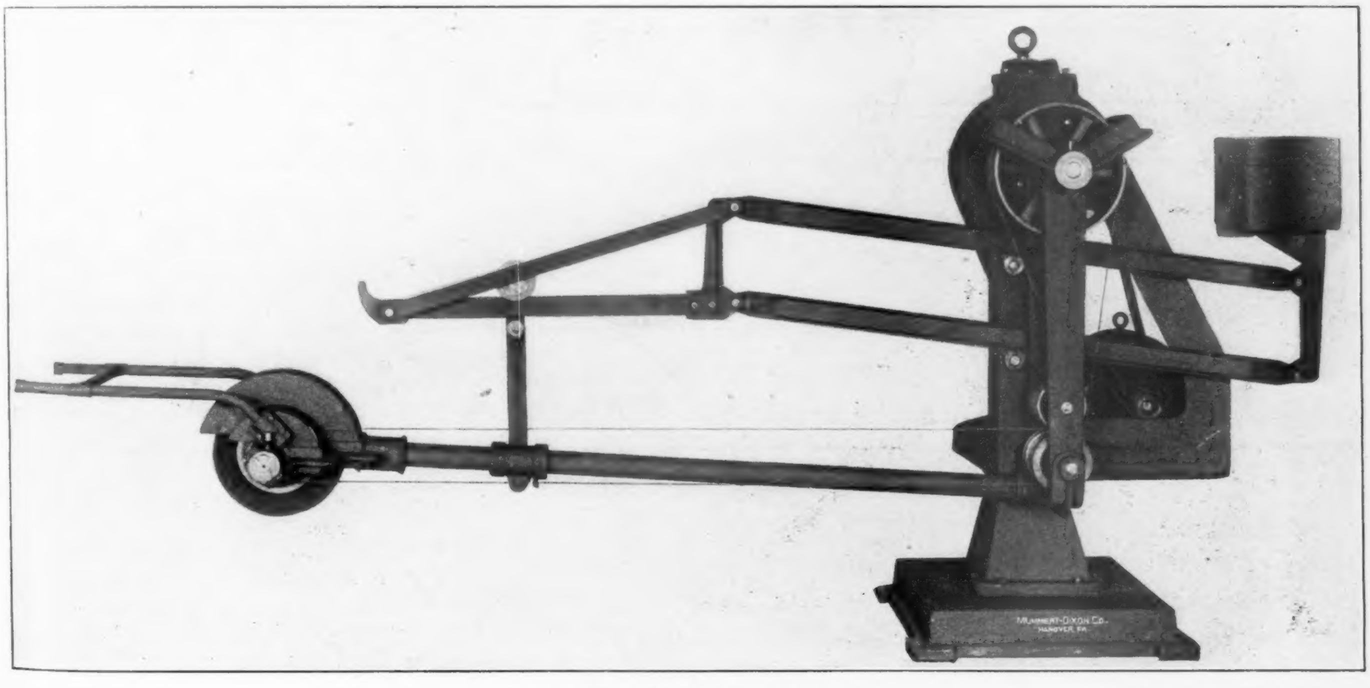
PORTABLE RADIAL SWING GRINDER

The grinding machine illustrated is made for grinding castings and doing other general buffing work. It is self-contained and is driven by a motor mounted on a suitable platform which is part of the main housing; the counterbalance for the swinging arm and grinding head is also mounted on the main housing. The machine needs no preliminary work for setting up and can be carried anywhere by a crane.

The arm with the grinding head can be turned through the entire circumference about the base. The grinding head and the swinging arm are carried back and forth by a roller bearing trolley which rolls on a track held in a horizontal position by two parallel arms. At the back end of these arms is placed the counterweight. The parallel arms keep the head balanced in any position the trolley may occupy on the track. This arrangement gives a free movement to the swinging arm and eliminates the tendency of the arm with its weight to find its center of gravity. The grinding head can be twisted in either direction to an angle of 90 deg. The emery wheel is driven by a single belt which is carried around the jointed connection of the swinging arm and hanging swing frame by two self-oiling idler pulleys, thence to the large pulley at the top. The upper pulley is driven by a shaft from the drive pulley on the inside of the housing. The motor is belted to this drive pulley. The swing frame hangs on two phosphor bronze bushings placed in the top bracket. These bushings form the bearings for the drive pulley.

The emery wheel in the grinding head is shielded by a hood over the top. The handles attached to the head enable the operator to obtain a good hold and to have full control of the head. The wheel arbor runs in phosphor bronze bearings with provision for taking up the wear. It has safety flanges and will take a wheel 18 in. diameter by 3 in. face. A safety shaped wheel is recommended.

This machine is manufactured by the Mummert-Dixon Company, Hanover, Pa.



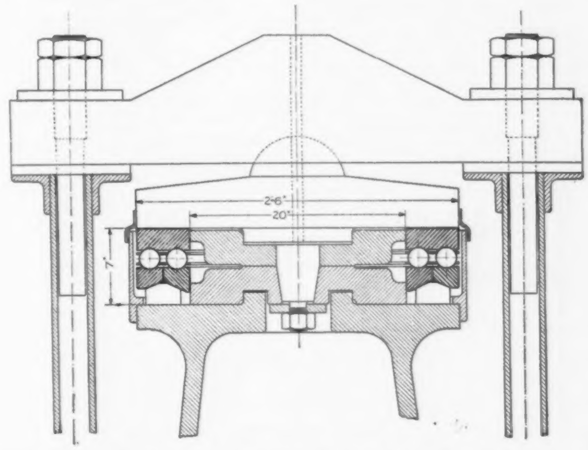
Portable Radial Swing Grinder

SPEED OF NEW DESTROYER.—While running her standardization trials the new destroyer *MacDougla* made a maximum speed of 32.07 knots for one mile and averaged for five full-speed runs 31.52 knots.—*Scientific American.*

BALL BEARINGS ON TURNTABLES

BY ARTHUR V. FARR

The application of ball bearings to railway turntables in this country, up to the present time, has not been investigated to any considerable extent. It has been left to the foreign railways to adopt ball bearings for this purpose, and they have found them so advantageous that their use has become quite common.



Section Through the Center Support of a Ball-Bearing Turn Table Used by the Victorian State Railway, Australia

The Victorian State Railway in Australia has equipped its roundhouses and terminals with ball bearing turntables, and after a period extending from 1911, this road has experienced such satisfaction that they are ordering large numbers of additional ball bearings for this purpose. In the accompanying drawing a Victorian State Railway turntable of 200 tons capacity, equipped with S. K. F. ball bearings, is shown. It will be noted that there are two rows of large (2 in.) balls in this bearing arranged in staggered relation. This is a double thrust bearing of special construction, mounted in the center of the turntable in such a way as to act as a pivot. The Victorian State Railway has been using these ball bearings for turntables for capacities ranging from 150 to 225 tons.

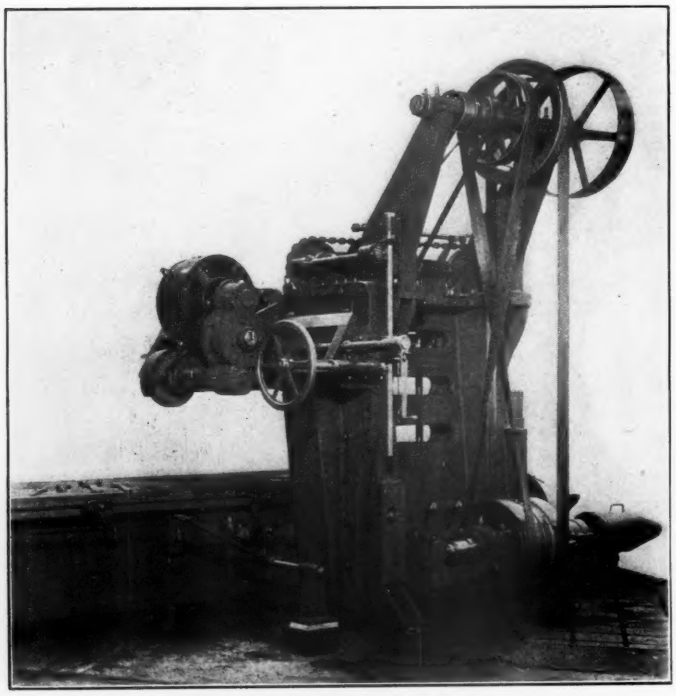
One advantage of using this type of ball bearing is that any unbalanced load on the table is taken care of by the pivot plate, and the whole load is uniformly distributed to both rows of balls by the use of a self-adjusting ring supporting the two lower ball races. A steel shell surrounding the thrust bearing serves to retain the lubricant and to keep it free from the possible intrusion of dust and grit, insuring the greatest degree of reliability, and preserving the accuracy of the ball bearings for the table support.

GRINDING MACHINE OF THE OPEN SIDE PLANER TYPE

A grinding machine of the open side planer type suitable for grinding frogs, switches, crossings and other similar work, employing materials not workable with steel cutting tools, is shown in the accompanying illustration.

The machine, which is built by the Detrick & Harvey Machine Company, Baltimore, Md., consists of the regular reciprocating table, bed, post and cross beam of the standard open side planer built by the same manufacturers. In place of the ordinary cutting tool is substituted a grinding wheel carried in a saddle which can be fed up or down, or in either direction laterally. The grinding wheel is mounted on a spindle which bears in long bronze bushings, and is belt driven from an independent electric motor mounted on the saddle.

The saddle has a sliding fit on the cross beam and can be traversed by hand from either side of the machine. A power



Open Side Planer Type Grinding Machine

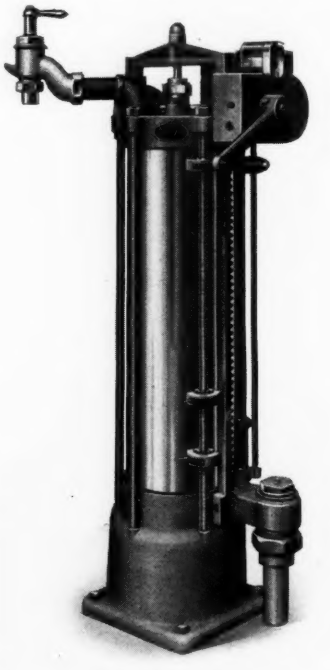
cross feed can also be provided. The cross rail is carried on the face of the post with a sliding fit and can be fed up or down by hand, and adjusted by hand or power as desired. Being fully counterbalanced it is easily adjusted.

The table is gibbed down on the side next to the post. It is driven by a spiral pinion and rack. The reverse is obtained through shifting belts or a reversing motor as desired. The table drive in a belt driven machine is accomplished through a countershaft mounted on the post. It is independent of the drive for the grinding wheel and may be by belt from motor or line shaft or by direct connected reversing motor.

The grinding wheel is 18 in. in diameter by 3 in. face, running at about 1,300 r. p. m. The speed of the table is 40 ft. per minute, the speed being the same in both directions.

LONG DISTANCE GASOLENE AND OIL PUMP

The accompanying illustration shows a long distance 5 gal. pump recently brought out by S. F. Bowser & Company, Inc., Ft. Wayne, Ind., which will be found useful in railroad oil houses where saving of time is an important item. The pump delivers quickly large quantities of gasolene or other oils with but little labor and without the tediousness usually experienced with the ordinary self-measuring pump, the plunger being returned to its original position with a few quick, easy turns of the handle. It takes but little room in the building and is flexible as to range of quantities measured.



Five-Gallon Pump for Oil or Gasolene

This pump is designed for measuring and distributing either volatile or non-volatile oils, varnishes, etc. It may be located at any convenient point within the building and connected to a tank located at any distance from the pump, provided the vertical suction is not more than 12 ft. It is so arranged that at the option of the operator, by adjusting a stop on the quantity rod, 5 gal., 2 gal. or 1 gal. may be discharged at one stroke. The different measurements are regulated by adjusting the stops on the pump, which is very easily and quickly done. It is also provided with a graduated scale showing all intermediate gallons, half gallons, quarts or pints, making the pump virtually one with a maximum capacity of 5 gal., and a minimum of one pint, so that any intermediate quantity can be pumped and accurately measured. Gears on the pump are designed to provide a quick return motion, so that one revolution on the return is equal to six revolutions of the handle on the upward stroke. Two cross bars are provided which evenly distribute the weight of the plunger, making the pump easy of operation.

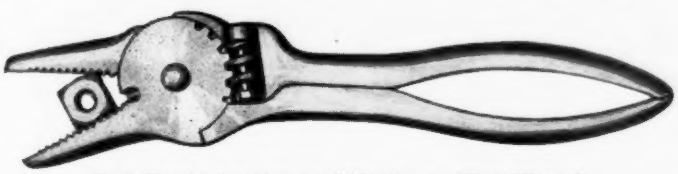
Located in the head of the pump is a discharging register which tallies the number of gallons pumped, in multiples of five up to 50 and then repeats. A meter is also provided which registers all liquid discharged, to 100,000 gal., and then repeats.

The pump is provided with a locking device so that it can be operated only by those persons in possession of a key.

QUICKER SERVICE BETWEEN LONDON AND PARIS.—At a conference held recently in Paris between representatives of the Brighton Railway Company and officials of the State railways of France, many improvements and accelerations in the services between London and Paris, via Newhaven and Dieppe, were arranged to come into operation next year. The morning services from London and Paris will be accelerated by about half an hour in each direction, and an afternoon service between London and Paris will be run during the summer months.

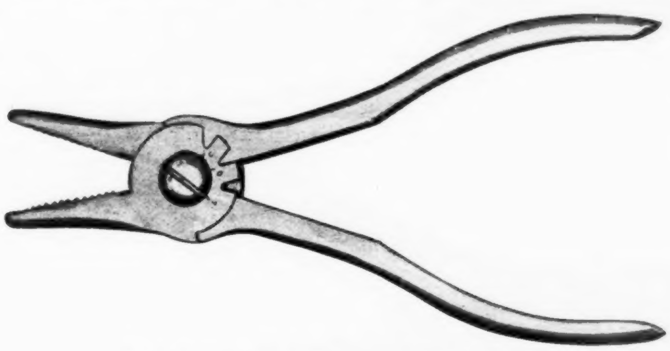
ADJUSTABLE PLIERS

A hand tool of general utility is shown in the accompanying illustrations. The device consists of pliers provided with one jointed lever, enabling the movement of the jaws independently of the handles. One of the designs is made with a worm thumb nut, making it thoroughly adjustable, it being possible while the tool is in use in any capacity to definitely locate the jaws in any



Tool Ready for Use as Alligator or Pipe Wrench

position up to 30 deg. without movement of the handles. This feature gives the added advantage of a convenient tool for gripping and holding round bolts from turning, as well as for use on pipe and various sizes of nuts. The spread of the jaws is limited to an angle of 30 deg. by a double set of shoulders forming a rigid wrench, while at the same time the handles may be closed firmly together for a convenient grip. In using the tool as pliers,



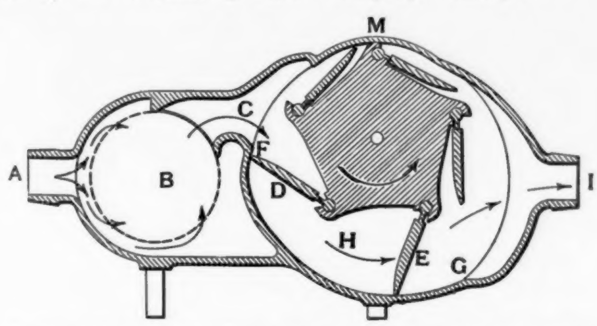
Tool Arranged as Pliers and Wire Cutter

when the jaws are spread at a broad angle covering a big job, the handles may be run down, approaching each other, for convenience in gripping.

The tool was invented by J. H. Baldwin, 1002 North Jefferson street, Springfield, Mo.

HIGH PRESSURE VOLUMETRIC AIR METER

An air meter for measuring compressor output, pneumatic tool consumption and pipe line losses has recently been introduced by the Kreutzberg Meter Company, Chicago, Ill. The



Section Showing Operating Parts of Volumetric Air Meter

meter is light and simple in construction and can be cut into a pipe line with little delay by any workman. The weight of the one inch size, for pressures up to 150 lb., is 28 lb.

A cross section of the case and operating parts of the meter is shown in the engraving. Opening *A* at the left is the inlet through which air is admitted to screen chamber *B*. From there it passes into the meter through *C*, impinging against vane *D* and causing the drum to rotate. As vane *D* passes the point of cutoff at *F* a fixed volume is contained between the vanes *D* and *E*. As soon as vane *E* reaches the point of outlet *G* the pressure in pocket *H* and the pipe line *I* are equalized and the contents of pocket *H* are discharged into the pipe line. The meter is sealed at the top by the shoe *M*.

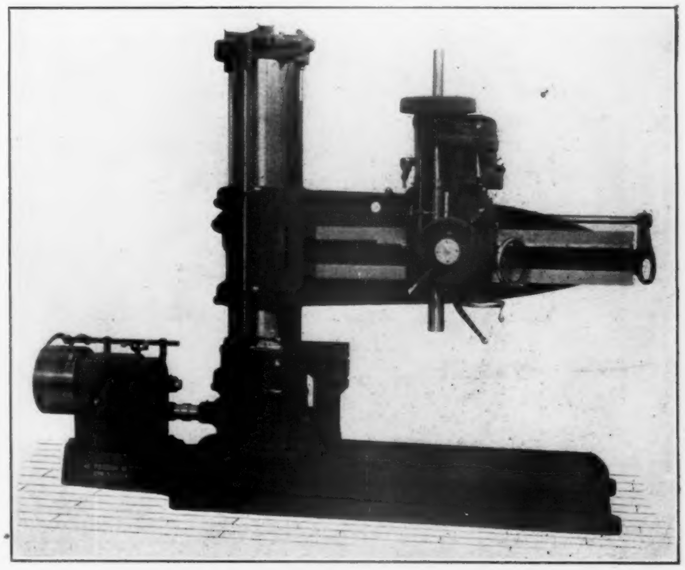
The energy required to operate the meter is claimed to be very small. The difference in pressure between the inlet and outlet of the meter will therefore be slight and leakage is unlikely to become an important factor in its operation.

LARGE RADIAL DRILL FOR HEAVY DUTY

The 5 ft., round column radial drill which is shown in the illustration is of similar construction to the 3 ft., round column drill which was fully illustrated and described on page 619 of the November, 1913, issue of this journal. Both machines are built by the Fosdick Machine Tool Company, Cincinnati, Ohio.

Aside from its greater size and capacity the 5 ft. drill differs principally from the earlier machine in the design of the table and base. For heavy steel drilling and tapping operations a liberal oil channel is cast around the base. The channel passes completely around the column where it drains into a large reservoir. This construction permits a full ribbed cross section of the base at a point immediately in front of the column where the greatest rigidity is required, and allows the outside T slots to extend back beyond the front of the column, making the full working surface of the base available.

Special attention is called to the location of the table which is also provided with oil channels draining to a pocket in one cor-



Heavy 5-ft. Radial Drill

ner. Any convenient receptacle may be placed at this point to receive the lubricant, thus eliminating the necessity of a pump.

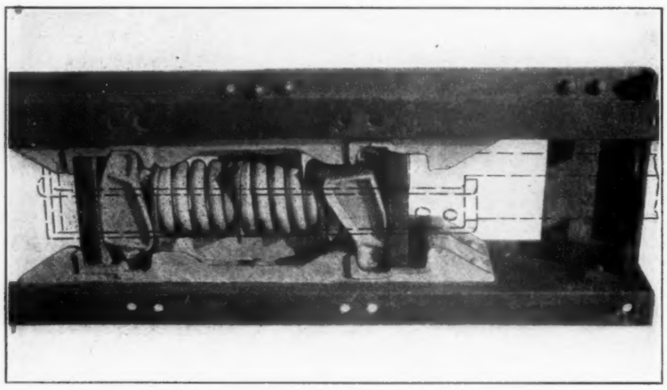
The efficiency of this machine is claimed to be high, as will be noted by the results of tests given below. These tests were made in machine steel 1½ in. thick on a stock machine, feed box driven, with the belt and frictions operating under ordinary conditions.

Diam. Drill	R. P. M.	Cutting Speed	Feed per Revolution	Feed per Minute	Cu. In. per Min.
1⅜ in.	391	141 ft.	.031 in.	12.1 in.	18
2 in.	273	143 ft.	.031 in.	8.5 in.	26.7
2½ in.	154	101 ft.	.031 in.	4.8 in.	23.5
3 in.	110	87 ft.	.031 in.	3.4 in.	24

The net weight of this machine is 10,500 lb., and it requires a 7½ to 10 h. p. motor if direct motor driven.

YOST DRAFT GEAR

The Yost lever friction draft gear, which is shown in the engravings, has been under development for several years and is now in service on about 2,000 cars. The gear is manufactured by the Hart-Otis Car Company, Limited, Montreal, Que., and is formed by placing friction levers between the followers and springs of a spring gear. It consists of four parts, the lugs, the levers, the springs and the followers. The springs are 6¼ in. by 8 in. M. C. B. standard, and the followers are the standard for spring gears.



Yost Draft Gear with One Set of Levers Compressed

In the operation of the gear the resistance is slight at the start of the travel and gradually increases until the full travel is attained. The recoil is low but is sufficient to release the gear. It is claimed that the action is smooth and gradual at all points of the travel and the change from spring to spring and lever action is so gradual that it cannot be noticed. For the first ⅜ in. of travel, the friction levers move bodily, giving the spring a free action. This gives the equivalent in resistance to the old 6¼ in. by 8 in. spring gear to this point. The reason for making this initial travel low is to allow the engineman to start a long train without having to bunch the slack.

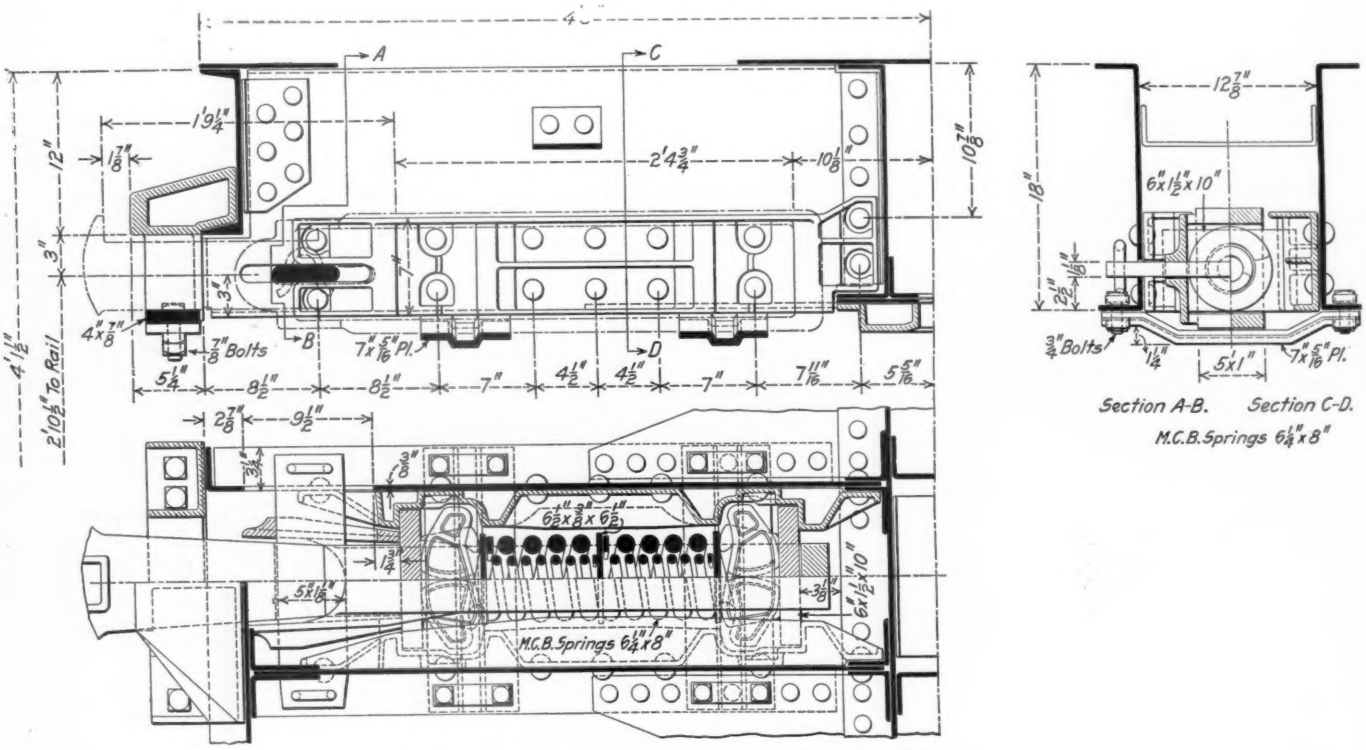
From ⅜ in. of travel, the friction levers begin to rotate, increasing from 9,800 lb. at ⅜ in. travel to 22,500 lb. at 11/16 in. of travel, which, up to this point, is the equivalent in resistance to the G spring gear. The balance of the travel is a gradually increasing resistance up to 300,000 lb. at the extreme travel. This resistance is made possible by the lever action between the coupler, draft lug and springs, together with the friction caused by the movement of these parts.

During the entire movement of the coupler, the spring compression is proportional to the travel of the friction levers and the spring cannot become solid, as it has still ¼ in. free motion when the final travel of the coupler is reached. This, it is claimed, not only greatly increases the life of the spring, but makes the gear self-adjusting as wear takes place.

The levers are so shaped that when extreme travel is reached, all moving parts form a rigid abutment transmitting the force beyond the capacity of the draft gear to the car. The spring compression during the last ⅛ in. of coupler movement is ¾ in.

In buffing, the blow acts directly on the draft gear through the coupler, and not on the yoke. The yoke only comes into action in pulling. This allows a free swivel movement of the yoke for any side movement of the coupler, preventing the shearing of the yoke and coupler rivets.

The levers are designed to give a leverage in compression but none in recoil. The action of the gear in recoiling is the reverse of that in compression, except that the levers being free to move bodily, have no lever action. The power returning the gear to normal position is that of the compressed spring (19,000 lb.). The spring bearing on the inner end of the levers while the outer ends are free, it is claimed, makes it impossible for the levers to stick, become displaced, or return to any position other than normal. The levers are alike for all types of the gear and are interchangeable.



Application of Yost Draft Gear to a Steel Underframe Car

Coal Briquettes.—Coal briquettes to the amount of 181,859 tons, valued at $1,007,327, were manufactured in 1913, according to Edward W. Parker, of the United States Geological Survey. Compared with 1912, there was a decrease of 17 per cent in tonnage, but an increase of 5½ per cent in value.—*Power.*

NEWS DEPARTMENT

The Atchison, Topeka & Santa Fe has increased the working time of its locomotive repair shops at Topeka from eight to nine hours a day. The car repair shops have also recently changed from a 48 hour week to a 54 hour week.

On Friday, May 1, the radio telegraph operators of the Delaware, Lackawanna & Western carried on telephone conversation, without wires, between Scranton and a car on an express train traveling between Scranton and Stroudsburg, a distance of about 50 miles.

The Southern Pacific reports that the accident record of the road for March was one of the best in its history. Not a single fatality, either to a passenger or an employee, occurred from the operation of trains or in industrial pursuits. The Pacific system, 6,380 miles, carried 3,079,000 passengers an aggregate distance of 102,655,000 miles in March without a single injury; and of the 43,000 employees only one was injured in an accident. The Southern Pacific has a record of having operated its entire line for five years and eight months without a fatal accident to a passenger resulting from train operation.

Marcus A. Dow, general safety agent of the New York Central lines, reports that, as a result of the vigorous campaign which has been conducted on the New York Central, the number of trespassers killed on the tracks of that company in seven months ending April 30 was 38 less than in the same period one year ago; 98 this year and 136 last year. The number of trespassers injured has also fallen off. It has been noticed that fewer persons walk on the tracks in the manufacturing districts where men and women going to and from shops have habitually walked on the railroad right of way. Mr. Dow reports a growing tendency among the judges and magistrates to punish such offenders.

The relief department of the Chicago, Burlington & Quincy has issued its twenty-fifth annual report covering the year ending December 31, 1913. The receipts for the year were $619,958, of which $580,388 represented contributions of members; $20,625 income from investments, and $18,944 cash advanced by the railroad. Benefit orders to the amount of $616,905 were cashed by the treasurer. From June 1, 1889, to December 31, 1913, the relief department has paid out in benefit orders on account of sickness or accidents a total of $9,451,300. The total payments by the railroad company from its own funds in establishing, operating and maintaining the relief department from 1889 to 1913, inclusive, have amounted to $1,679,437.

On the Cleveland division of the Baltimore & Ohio, the "safety first" movement has been expanded into an efficiency movement with a gratifying degree of success; and now the superintendent, Mr. Lechlider, proposes to the employees that they go a step farther and include in their program a more intimately personal element; safety, efficiency, thrift. The Baltimore & Ohio for years has had a relief department, and in this department there is a savings bank, conducted for the benefit of all employees of the road; and it is proposed to "boost" the savings department by encouraging employees to buy for themselves homes. This department owns a house at Lorain which it will sell for $1,900; the first payment to be $100. Thereafter monthly instalments of $22.50 would be paid until the whole sum is liquidated.

CAR DEPARTMENT ORGANIZATION

The article on "Car Department Organization and Efficiency," which appeared on page 235 of our May, 1914, issue, was credited to A. Carey. It should have been published under the name of J. H. Pitard, master car painter of the Mobile & Ohio at Whistler, Ala.

AUTOMATIC PARCEL ROOM

The Chicago & North Western has recently placed in the waiting rooms of a number of its more important stations automatic coin-controlled parcel-checking lockers, consisting of steel cabinets of various sizes in which passengers may check their own hand baggage, taking it out of the locker as desired, without delay, by the deposit of a coin. Thus far the cabinets have been liberally patronized by the passengers.

AIR BRAKE STORY CONTEST

A. L. Humphrey, vice-president and general manager of the Westinghouse Air Brake Company, has announced a competition for an air brake story, which is open to railway employees. Following are the conditions of this contest:

"For the best true stories illustrating the value of the Westinghouse air brake, in terms of performance and capacity, as determined by an independent committee of judges, we will make the following awards in cash:

First prize story	$1,000	Fourth prize story	$150
Second prize story	500	Fifth prize story	100
Third prize story	200	Sixth prize story	50

"The purpose we have in mind is to draw from the experience and practical knowledge of railroad officers and employees, striking stories of air brake performance. We know that the history of the art of braking railroad trains is rich in dramatic, but as yet unwritten narrative. On the one hand is a vast amount of such material as spectacular escape from wreck or disaster; and on the other hand a still larger —and largely unexplored—field covering the concrete evidences that efficient train control is the supreme factor in the ability to handle heavier freight and passenger traffic; and that increased tonnage, longer trains, higher speeds, etc., are simply visible demonstrations of the controlling influence of the air brake as expressed in the larger earning power possible from operation.

"Each 'story' must be written either from the practical experiences or personal observations of the writer or from information obtained at first hand from railroad men who actually know the facts. Each contestant may choose his own individual style of expression, use railroad dialect if desired, and illustrations if thought advisable. Correct names, dates, places and persons should be used so far as possible, but fictitious substitutes may be employed provided this is so stated in the transmitting letter and the fundamental facts related have actually occurred. There is no limitation as to the time when the facts given in the story may have occurred, but naturally these facts will be of larger interest if covering recent years and particularly if they apply to present standard forms of Westinghouse brake equipment. The stories will be judged primarily upon the convincing character of the narrative as to the value of the air brake; originality, striking or unusual features; accuracy of facts given; relation of the story to present day conditions; concise expression; and brevity.

"The contest is open to bona fide employees of any railroad in the United States, operating regular traffic schedules, without limitation of any kind as to age, character of work, education, or other qualification.

"No 'story' shall be more than two thousand words in length. Manuscripts exceeding two thousand words will not be considered in the competition. Each 'story' should be

written on one side of the sheet only and preferably typewritten. Neither name, address, nor other means of identification should be shown except in the transmitting letter.

"No expense is involved in entering this contest, but it is understood that all narratives submitted become the property of the Westinghouse Air Brake Company whether securing an award or otherwise.

"Decision as to merits of the stories submitted will be placed absolutely in the hands of a committee of judges composed of three prominent persons not associated in any way with the Westinghouse interests.

"Each 'story' should be addressed to the 'Judges of Prize Contest,' room 2121, 165 Broadway, New York, N. Y. When received and serially numbered, the manuscripts, without name or other identification, will be turned over to the committee of judges by a disinterested party appointed by and acting for the committee, and who will retain the transmitting letters after making careful record thereon of the serial number of the manuscript. The judges will, therefore, pass upon the manuscript submitted without knowing by whom written until after the award is made.

"All stories to be considered in this competition must be in the hands of the committee on or before August 1, 1914. Announcement of awards by the committee of judges will be made as promptly as possible thereafter."

MEETINGS AND CONVENTIONS

Cornell Alumni at Atlantic City.—Professor Dexter S. Kimball, of Cornell University, will be the guest of honor at the ninth annual dinner of the Cornell alumni, who will attend the Master Car Builders' and Master Mechanics' conventions at Atlantic City. The dinner will be held on the closing day of the Master Car Builders' convention, Friday, June 12.

American Society for Testing Materials.—The seventeenth annual meeting of the American Society for Testing Materials will be held at the Hotel Traymore, Atlantic City, N. J., June 30-July 3. The program is divided into sessions on non-ferrous materials, steel, cement and concrete, lime, ceramics and road materials, preservative coatings and testing apparatus.

International Railroad Master Blacksmiths' Association.—The following are the subjects to be considered at the convention to be held in Milwaukee, Wis., August 18 to 20, 1914: Flue Welding; Making and Repairing Frogs and Crossings; Carbon or High Speed Steel; Tools; Electric Welding; Drop Forging; Spring Making and Repairing; Piece Work and Other Methods; Locomotive Frame Making and Repairing; Oxy-Acetylene Cutting and Welding; Case Hardening; Heat Treatment of Metals, and Shop Kinks.

International Railway General Foremen's Association.—In order to build up the membership of the International Railway General Foremen's Association, the secretary has sent out letters to general foremen throughout the country urging them to become members and also to superintendents of motive power calling their attention to the aims of the association and to the character of the work which it has accomplished in the past. The secretary states that the association is a business proposition and asks the motive power officers to inform their general foremen that if they become members and attend the conventions the time will not be deducted from their vacation period.

Canadian Railway Club.—At its meeting in Montreal, on May 12, the Canadian Railway Club elected officers for the ensuing year as follows: President, William McNab, principal assistant engineer, Grand Trunk; first vice-president, L. C. Ord, assistant master car builder, Eastern lines, Canadian Pacific; second vice-president, R. M. Hannaford, assistant chief engineer, Montreal Tramways; secretary, James Powell, Grand Trunk; treasurer, W. H. Stewart, Canadian Pacific. The report of the secretary shows an increase in membership during the past year, and that of the treasurer shows a balance in the treasury of over $3,000. The club has been incorporated under the laws of Quebec.

Western Railway Club.—At the annual meeting of the Western Railway Club in Chicago the following members were elected as officers for the ensuing year: W. E. Pratt, Chicago & North Western, president; H. H. Harvey, Chicago, Burlington & Quincy, first vice-president; J. H. Tinker, Chicago & Eastern Illinois, second vice-president; Joseph W. Taylor, secretary-treasurer. The following were elected to the board of directors: J. M. Borrowdale, Illinois Central; W. E. Dunham, Chicago & North Western; A. R. Kipp, Minneapolis, St. Paul & Sault Ste. Marie. The following were elected library trustees: H. T. Bentley, Chicago & North Western; W. E. Sharp, Grip Nut Company; Dr. W. F. M. Goss, University of Illinois.

Traveling Engineers' Association.—The twenty-second annual convention will be held at the Hotel Sherman, Chicago, Ill., commencing at 10 a. m., Tuesday, September 15, and continuing four days. Special rates have been arranged at the hotel, and in anticipation of this being the largest convention yet held, the secretary urges on members the necessity of making reservations in ample time. The subjects to be discussed this year are as follows:

Difficulties accompanying prevention of dense black smoke and its relation to cost of fuel and locomotive repairs; Martin Whalen, chairman. Operation of all locomotives with a view of obtaining maximum efficiency at lowest cost; J. R. Scott, chairman. Advantage to be derived from the use of mechanical stokers, considering (first) increased efficiency of the locomotive; (second) increasing the possibility of securing a higher type of candidates for the position of firemen; (third) the utilization of cheaper grades of fuel; J. H. DeSalis, chairman. The care of locomotive brake equipment on line of road and at terminals; also, methods of locating and reporting defects; Geo. H. Wood, chairman. Advantage derived from the use of speed recorders and their influence on operating expense; Fred Kerby, chairman. Practical chemistry of combustion; A. G. Kinyon. Scientific train loading; tonnage rating; the best method to obtain maximum tonnage haul for the engine over the entire division, taking into consideration the grades at different points on the division; O. S. Beyer, Jr.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.

American Railway Master Mechanics' Assoc.—J. W. Taylor, Karpen building, Chicago. Convention, June 15-17, 1914, Atlantic City, N. J.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga. Convention, July 20-22, 1914, Hotel Sherman, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa. Convention, June 30-July 4, Hotel Traymore, Atlantic City, N. J.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Convention, June 16-19, St. Paul-Minneapolis, Minn.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North Fiftieth Court, Chicago; 2d Monday in month, except July and August, Lytton building, Chicago.

Chief Interchange Car Inspectors' and Car Foremen's Association.—S. Skidmore, 946 Richmond street, Cincinnati, Ohio. Convention, August 25-27, 1914, Cincinnati, Ohio.

International Railway Fuel Association.—C. G. Hall, 922 McCormick building, Chicago.

International Railway General Foremen's Association.—William Hall, 829 W. Broadway, Winona, Minn. Convention, July 14-17, 1914, Hotel Sherman, Chicago.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Convention, August 18-20, 1914, Milwaukee, Wis.

Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York.

Master Car Builders' Association.—J. W. Taylor, Karpen building, Chicago. Convention, June 10-12, 1914, Atlantic City, N. J.

Master Car and Locomotive Painters' Assoc. of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Convention, September 8-11, 1914, Nashville, Tenn.

Niagara Frontier Car Men's Association.—E. Frankenberger, 623 Brisbane building, Buffalo, N. Y. Meetings monthly.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Convention, September 15, 16, 17 and 18, 1914, Hotel Sherman, Chicago, Ill.

PERSONALS

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL

A. C. ADAMS has been appointed superintendent of motive power of the United Railway, with headquarters at Portland, Ore.

H. COCKFIELD has resigned as locomotive superintendent of the Entre Rios Railways at Parana, Argentine.

A. C. HINCKLEY has been appointed superintendent of motive power and machinery of the Oregon Short Line, with headquarters at Salt Lake City, Utah. Mr. Hinckley was born in New York in 1863. He passed through the grammar school and attended Meads College for two years, beginning railway work about 1885 with the Chicago, Pekin & Southwestern, with which road he remained for six years as apprentice and machinist. He was then for three years locomotive engineer on the Chicago, Burlington & Northern out of LaCrosse, Wis., and subsequently was for three years with the Utah Central as road foreman of engines and master mechanic at Salt Lake City, Utah; master mechanic of the Denver & Rio Grande at Salida, Colo., for three years; and in charge of the mechanical and car departments of the Cincinnati, Hamilton & Dayton at Lima, Ohio, for four and a half years. Mr. Hinckley went to the Southern Pacific in January, 1910, as master mechanic at West Oakland, Cal., which position he resigned to become superintendent of motive power and machinery of the Oregon Short Line, on May 1.

A. C. Hinckley

L. A. RICHARDSON, mechanical superintendent of the third district of the Chicago, Rock Island & Pacific at El Reno, Okla., has been transferred to Des Moines, Iowa, as mechanical superintendent of the first district, succeeding H. C. Van Buskirk, resigned.

J. C. NOLAN, master mechanic of the St. Louis, Brownsville & Mexico, has been appointed superintendent at Kingsville, Tex., succeeding R. F. Carr.

R. L. STEWART has been appointed mechanical superintendent of the Rock Island Lines at El Reno, Okla., succeeding L. A. Richardson, transferred.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

A. H. BINNS has been appointed district master mechanic of the Ontario division of the Canadian Pacific at West Toronto, Ont., succeeding L. F. Hamilton.

W. W. BOLINEAU has been appointed road foreman of engines of the Central of Georgia at Macon, Ga.

J. J. CAREY, master mechanic of the Baltimore & Ohio Southwestern at Washington, Ind., has been appointed master mechanic of the Texas & Pacific at Marshall, Tex., succeeding G. H. Langton, resigned.

H. A. CRANCE has been appointed road foreman of engines of the Chicago, Burlington & Quincy at Brookfield, Mo., succeeding C. E. Lowe.

P. J. COLLIGAN has been appointed master mechanic of the Illinois division of the Rock Island Lines at Chicago, Ill., succeeding R. L. Stewart, promoted.

JOHN DICKSON, general master mechanic of the Spokane, Portland & Seattle and the Oregon Trunk, at Portland, Ore., has had his jurisdiction extended over the Spokane & Inland Empire.

A. H. FIRNHABER has been appointed master mechanic of the New Iberia & Northern at New Iberia, La.

C. E. FOWLER has been appointed master mechanic of the Jefferson & North Western at Jefferson, Tex.

W. GRAFF has been appointed road foreman of engines of the Baltimore & Ohio Southwestern at Chillicothe, Ohio.

JOHN HALLMAN has been appointed master mechanic of the North Louisiana & Gulf at Hodge, La., succeeding G. H. Huntley.

F. A. HAMM has been appointed master mechanic of the Staten Island Rapid Transit at Clifton, N. Y.

F. HEINS has been appointed master mechanic of the Gulf & Sabine River at Fullerton, La.

M. P. HOBRAN has been appointed road foreman of engines of the Baltimore & Ohio at Dayton, Ohio.

W. T. LOVELL has been appointed master mechanic of the Oregon-Washington Railroad & Navigation Company, with headquarters at Portland, Ore., succeeding James Healy, resigned.

J. T. LUSCOMBE has been appointed master mechanic of the Ohio River division of the Baltimore & Ohio, with office at Parkersburg, W. Va. Mr. Luscombe was born on June 29, 1874, at Queenstown, Cork county, Ireland. After a high school education at Belleville, Ont., he began railway work in 1891 with the Grand Trunk at that place. During the ten years from 1891 to 1901 he was with a number of roads as machinist, and also studied in the Scranton schools. In May, 1901, he was made general foreman of the Baltimore & Ohio at Uhrichsville, Ohio, and was later transferred to Newark, Ohio, as machine shop foreman. In 1905 he went with the Chicago & Alton as machine shop foreman at Bloomington, Ill., and in September, 1907, became general foreman of the Toledo & Ohio Central at Bucyrus, Ohio. In March, 1908, he was promoted to master mechanic, and four years later was appointed master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Bellefontaine, Ohio. He resigned from that position in October, 1913, to go to the National Boiler Washing Company, Chicago, and now returns to railway work as master mechanic of the Ohio River division of the Baltimore & Ohio, as above noted.

T. MCCLAIN has been appointed master mechanic of the Arkansas, Louisiana & Gulf at Monroe, La., succeeding W. L. Essex.

A. E. MCMILLAN has been appointed assistant master mechanic of the Baltimore & Ohio Southwestern at Cincinnati, Ohio.

F. W. MURPHY has been appointed master mechanic of the Chicago, Ottawa & Peoria at Ottawa, Ill.

A. PEERS has been appointed district master mechanic of the Canadian Pacific in charge of the Winnipeg, Man., terminals.

B. D. RICHARDSON has been appointed master mechanic of the Midland Valley at Muskogee, Okla., succeeding James Carr.

R. E. Rowe, roundhouse foreman of the St. Louis, Brownsville & Mexico, has been appointed master mechanic at Kingsville, Tex., succeeding J. C. Nolan, promoted.

J. A. Sheppard has been appointed master mechanic on the Missouri Pacific at Coffeyville, Kan., succeeding G. K. Stewart, transferred.

P. Smith has been appointed road foreman of equipment of the Rock Island Lines at Chicago, Ill., succeeding Wm. Germer.

Oscar Stevens has been appointed road foreman of engines of the Baltimore & Ohio Southwestern at Cincinnati, Ohio.

G. K. Stewart, master mechanic of the Missouri Pacific at Coffeyville, Kan., has been transferred to De Soto, Mo.

W. M. Wilson has been appointed master mechanic of the Mexico division of the Rock Island Lines at Dalhart, Tex., succeeding P. J. Colligan, transferred.

CAR DEPARTMENT

G. M. Argue has been appointed car foreman of the Canadian Northern at Fort Francis, Ont., succeeding E. W. Winnebeck, resigned.

J. P. Brendel has been appointed general foreman of the car shops of the Southern Pacific at Sacramento, Cal.

H. C. Griffin has been appointed general car inspector of the Canadian Pacific, Eastern lines, with headquarters at Montreal, Que., succeeding L. C. Ord, promoted.

F. Heim has been appointed master car builder of the Midland Continental at Jamestown, N. D., succeeding E. J. Hazelton.

W. A. Martin has been appointed general car foreman of the Bangor & Aroostook at Milo Junction, Maine.

T. M. Ramsdell, master car builder of the Chicago & Alton, has been appointed master car builder of the Oregon-Washington Railroad & Navigation Company at Albina shops, Portland, Oregon.

A. L. Tetu has been appointed car foreman of the Great Northern at Cass Lake, Minn., succeeding J. Becker.

SHOP AND ENGINE HOUSE

J. Aitken has been appointed locomotive foreman of the Canadian Pacific at Sherbrooke, Que., succeeding C. W. Stackhouse.

F. A. Bladorn has been appointed locomotive foreman of the Great Northern at Billings, Mont.

G. Brimacombe has been appointed locomotive foreman of the Canadian Pacific at Sortin Yard, Montreal, Que.

L. Cleary has been appointed assistant locomotive foreman of the Canadian Pacific at Outremont, Que.

J. G. Costello has been appointed general foreman of the Denver, Laramie & Northwestern at Denver, Colo.

G. F. Denne has been appointed foreman painter of the New York, Chicago & St. Louis at Chicago, succeeding C. Clark.

G. Drolet has been appointed general engine foreman of the Bangor & Aroostook at Milo Junction, Maine.

F. Fisher has been appointed general foreman of the Chicago, Peoria & St. Louis at Springfield, Ill.

W. F. Gallup has been appointed general foreman of the Atchison, Topeka & Santa Fe at Raton, N. M., succeeding I. H. Drake.

Henry Gardner, assistant superintendent of shops of the Baltimore & Ohio at Mt. Clare, Baltimore, Md., was a special apprentice with the Boston & Maine from 1896 to 1899, and not superintendent of apprentices as stated in the May issue.

R. J. Greiner has been appointed general foreman of the Missouri, Kansas & Texas at Smithville, Tex., succeeding Max Chase, resigned.

J. B. Harvard has been appointed general foreman of the Baltimore & Ohio Southwestern at Flora, Ill.

R. D. Hutchings has been appointed roundhouse foreman of the Southern at Selma, Ala., succeeding G. W. Thomas, resigned on account of ill health.

F. Kubeck has been appointed shop foreman of the Chicago & North Western at Green Bay, Wis., succeeding C. H. Matthews.

Thomas Long has been appointed roundhouse foreman of the St. Louis & San Francisco at Harwood, Ark.

A. D. McCharles has been appointed locomotive foreman of the Great Northern at Havre, Mont., succeeding F. W. Ramer.

Edward McCue has been appointed roundhouse foreman of the Erie at Ferrona, Pa., succeeding R. Edwards, transferred.

C. McLean has been appointed locomotive foreman of the Chicago Great Western at Oelwein, Iowa, succeeding H. Brinkman.

A. J. Maitland has been appointed locomotive foreman of the Canadian Pacific at Ignace, Ont., succeeding H. J. Reid, transferred.

F. M. Marely has been appointed roundhouse foreman of the Texas & Gulf (Gulf, Colorado & Santa Fe) at Longview, Tex.

W. P. Milon has been appointed locomotive foreman of the Great Northern at Whitefish, Mont.

B. J. Peasely has been appointed superintendent of shops of the Missouri Pacific at Argenta, Ark.

D. P. Phalen has been appointed locomotive foreman of the Great Northern at Butte, Mont.

F. A. Phillips has been appointed locomotive foreman of the Great Northern at Great Falls, Mont., succeeding R. Lloyd.

L. J. Poole has been appointed assistant boilershop foreman of the Erie at Meadville, Pa., succeeding William Williams, transferred.

G. Pratt has been appointed locomotive foreman of the Canadian Pacific at Souris, Man., succeeding A. Peers, promoted.

Thomas Purcell, boiler foreman of the Atchison, Topeka & Santa Fe Coast Lines at Winslow, Ariz., has been transferred to Richmond, Cal., as boiler foreman at that point.

H. J. Reid has been appointed assistant locomotive foreman of the Canadian Pacific at Souris, Man., succeeding G. Pratt, promoted.

C. E. Sarney has been appointed locomotive foreman of the Canadian Pacific at Megantic, Que.

O. B. Schoenky has been appointed shop superintendent of the Southern Pacific at Sacramento, Cal.

D. S. Watkins has been appointed shop superintendent of the Southern Pacific at Sacramento, Cal.

James Weir has been appointed night locomotive foreman of the Canadian Pacific at Outremont, Que.

PURCHASING AND STOREKEEPING

W. R. Dawson has been appointed storekeeper of the Toledo division of the Baltimore & Ohio at Dayton, Ohio, succeeding T. H. Baker.

F. A. Fitzgerald has been appointed storekeeper of the Baltimore & Ohio at Washington, Ind., succeeding H. P. McQuilkin, promoted.

O. V. McQuilkin has been appointed storekeeper of the Baltimore & Ohio at Glenwood, Pa., succeeding E. W. Thornley, promoted.

SUPPLY TRADE NOTES

Leman D. Doty, for 23 years purchasing agent for the Illinois Steel Company, died on May 24 at his home in Chicago.

Victor J. Shepard, for the past ten years chief draftsman of the Lima Locomotive Corporation, Lima, Ohio, has resigned.

The Welding Materials Company, New York, has moved its office from 149 Broadway to the Engineering building, 114 Liberty street.

The Chicago-Cleveland Car Roofing Company has removed its Chicago office from the Peoples Gas building to 535 Railway Exchange.

C. P. Williams, recently of the National Lock Washer Company, has become connected with The Efficiency Company, Railway Exchange, Chicago.

E. H. Barnes, southern representative of S. F. Bowser & Company, Inc., Fort Wayne, Ind., has severed his connection with that company, effective May 15.

The Chicago office of the Falls Hollow Staybolt Company, formerly in the Old Colony building, is now located in the Fisher building, 343 S. Dearborn street.

The offices of Paul Dickinson, Inc., have been moved from the Security building to 3346 South Artesian avenue, Chicago, and has discontinued its downtown office.

The Carbo Steel Post Company, Inc., has enlarged its offices in the Rand McNally building, 538 South Clark street, Chicago, and now occupies rooms 881 to 887.

Flint & Chester, Inc., New York, have been appointed selling agents for the National Graphite Lubricator Company, Scranton, Pa., for the East, including the railroads in the territory north and east of Buffalo and Baltimore.

George M. Black, treasurer of the Detroit Seamless Steel Tubes Company and the Monarch Steel Castings Company, and secretary of the Michigan Malleable Iron Company, all of Detroit, Mich., died in that city on May 5.

The Chicago agency of the Industrial Works, Bay City, Mich., formerly with Mudge & Co., has been discontinued. For the present the Chicago territory will be handled from the main office in Bay City, but in the near future a sales office will be opened in Chicago under the name of the Industrial Works.

Colonel Harlow D. Savage, general eastern sales manager of the American Arch Company, 30 Church street, New York, has been elected vice-president of that company. A photograph, and a sketch of Colonel Savage's career were published in the April issue of the Railway Age Gazette, Mechanical Edition, page 218.

Louis H. Burns, who was formerly connected with the office of the motive power department of the Chicago, Rock Island & Pacific, has been appointed western representative of the injector department of William Sellers & Company, Inc., Philadelphia. His office will be on the ninth floor of the Lytton building, Chicago.

F. N. Kollock, Jr., formerly district manager of the Seattle office of the Westinghouse Electric & Manufacturing Company, has resigned his position to become treasurer and assistant secretary of the Westinghouse Lamp Company, Bloomfield, N. J. He has been succeeded by W. D. McDonald, formerly branch manager of the Minneapolis office. C. C. Curry has been appointed acting branch manager of the latter office.

W. Sharon Humes, for the past five years sales manager of the General Railway Supply Company, Chicago, has been retained by the Transportation Utilities Company, New York, which company acquired the entire business of the General Railway Supply Company on April 15. Mr. Humes' office will be in Chicago, as heretofore; and he will represent the new company in all of the territory west of Pittsburgh.

Alexander B. Scully, president of the Scully Steel & Iron Company, died on May 7 at his home in Chicago. Mr. Scully was born in Chicago on November 29, 1856, and after attending the public schools, began his business career as a messenger boy. In 1875 he entered the employ of Joseph T. Ryerson, where he remained until 1885. In 1886 he formed the W. F. Mallory Company, which firm sold out to Joseph T. Ryerson & Son in 1890. In 1891 he formed the Scully-Castle Company, which later became the Scully Steel & Iron Company, of which he was president up to the time of his death.

F. W. Coolbaugh, widely known in the railway supply trade, died on Saturday morning, May 16, at his home in Philadelphia, Mr. Coolbaugh was born at Stroudsburg, Pa., on August 21, 1848. At the age of 12 he entered the employ of the Delaware, Lackawanna & Western Railroad as water boy on a gravel train. He later became telegraph operator and was subsequently chief despatcher at Hoboken. In 1882 he entered the railway supply field as a salesman for Armour & Osterhaut, manufacturers of railway lanterns. He later became senior member of the firm of Coolbaugh, McMunn & Pomeroy, general sales agents in New York and the east for Carnegie, Phipps & Company; the Cambria Steel Company; the Boies Steel Wheel Company; the Lukens Iron & Steel Company, and the Latrobe Steel Company. In 1895, he purchased the patent rights of the Marden brake beam, and established the Sterlingworth Railway Supply Company at Easton, Pa., where from 1896 to 1902 the beam was manufactured and applied to nearly half a million cars. He continued in malleable iron and rolling mill work until 1907, when he moved to Philadelphia as president of the Acme Railway Equipment Company, in the manufacture and sale of their uncoupling device.

Richard F. Spamer has been appointed general manager of the Stentor Electric Manufacturing Company, Inc., New York, a recently-formed company which is now taking over the business of the Electrical Experiment Company of the same city. Mr. Spamer was born in St. Louis on March 29, 1878. He entered the employ of the Bell Telephone Company of Missouri in 1895, and worked in the inspection and traffic departments of that company until 1903. In that year he became superintendent of plant of the Consolidated Fire Alarm Company, Chicago, and while holding that position developed and patented an automatic sprinkler supervisory system and various other kinds of fire alarm equipment. In 1907 he entered the employ of the Western Electric Company and was connected with that company's New York office as railway telephone engineer at the time of his appointment to his present position. While he was in the employ of the company, also, he developed and patented a number of appliances used in telephone train despatching.

R. F. Spamer

CATALOGS

Electric Hoists.—A 32-page catalog issued by the Sprague Electric Company, New York, is devoted to the electric hoists manufactured by that company. A number of tables are included giving ratings, capacities and weights.

Electric Fans.—A 30 page booklet issued by the Sprague Electric Works, 527 West Thirty-fourth street, New York, is descriptive of the various types of electric fans manufactured by that company. The booklet includes specifications.

Hydro Volume & Pressure Recorders.—Catalog B, from Herman Bacharach, 14 Wood street, Pittsburgh, Pa., contains considerable information and a number of charts which will prove valuable in making measurements of the flow and pressure of gas.

Electric Drills.—A leaflet just issued by the Independent Pneumatic Tool Company, Chicago, Ill., describes the Thor electric drill. These drills are portable and are equipped throughout with ball and roller bearings. The leaflet includes specifications.

Nut Tapping Machines.—The National Machinery Company, Tiffin, Ohio, has issued circular No. 1010-B describing the National 1 in. six spindle semi-automatic nut tapper. This machine is furnished for either belt or direct motor drive, and is also built in a 1½ in. size with ten spindles.

Electric Hoists.—Catalog D 1914, of the Brown Hoisting Machinery Company, Cleveland, Ohio, is devoted to the Brownhoist, tramrail systems, trolleys and electric hoists. The book contains 64 pages, and has a number of illustrations and a great deal of information pertaining to these systems.

Motors and Generators.—Fairbanks-Morse & Company, Chicago, Ill., have recently issued bulletins 27 and 29, dealing with direct current type motors and generators. Bulletin No. 210 from the same company is descriptive of Fairbanks-Morse internal starter motors. These bulletins are all thoroughly illustrated.

Induction Motors.—Bulletin No. 202-H from Fairbanks-Morse & Company, Chicago, Ill., describes that company's alternating current type B constant speed induction motors. The bulletin contains 20 pages, and is very completely illustrated, as well as giving a great deal of information pertaining to these motors.

Boring and Drilling Machines.—Catalog No. 2614 from the Betts Machine Company, Wilmington, Del., considers the horizontal boring and drilling machines and attachments manufactured by that company. The catalog contains 20 pages and has a number of good illustrations of the different sizes of the machine.

Flange Lubricators.—A 12-page pamphlet issued by the Detroit Lubricator Company, Detroit, Mich., describes and illustrates the Detroit Automatic Flange Lubricator. Besides illustrations of the lubricator, diagrams are included showing the way in which the device should be located on various types of locomotives.

Hess-Bright Ball Bearing Hangers.—A booklet issued by the Hess-Bright Manufacturing Company, Front street and Erie avenue, Philadelphia, gives descriptive matter with price list and dimensions of ball bearing shaft hangers and stands. The booklet also includes statements of power savings with these hangers as shown in tests.

Locomotive Sanders.—Bulletin No. 97, from Harry Vissering & Co., Chicago, Ill., contains 33 pages and deals with the various railway supplies manufactured by that company. These include, besides the Viloco locomotive sanders, Leach sanders, bell ringers, blower valves, metallic packing, sand driers, flexible sand pipe and brake steps.

Direct Current Motors.—Bulletin No. 41010, recently issued by the Sprague Electric Works, 527 West Thirty-fourth street, New York, is devoted to types C and D direct current motors manufactured by that company. Considerable descriptive matter is included, as well as a number of illustrations showing these motors in service.

Air Compressors.—The Laidlaw-Dunn-Gordon Company, Cincinnati, Ohio, has recently issued bulletin L-523-A describing the Cincinnati gear duplex Corliss steam driven air compressors, classes WA and XA. This bulletin contains 24 pages and has a number of illustrations and tables giving the various dimensions of the different compressors.

Automatic Heat Controller.—This is the subject of an illustrated booklet issued by the American Gas Furnace Company, 24 John street, New York. The instrument described is the invention of George F. Machlet, of that company, and it is claimed that it automatically controls temperatures to within 5 deg. Fahrenheit, thus providing a self-regulating gas furnace.

Elevators.—The Whiting Foundry Equipment Company, Harvey, Ill., has issued catalog No. 109, superseding No. 91, which is descriptive of the elevators manufactured by that company. These include elevators of the compressed air and hydro-pneumatic types, as well as electric elevators and hoisting machines. The catalog gives complete data pertaining to these various types.

Hydraulic Jacks.—A 90 page catalog issued by the Watson-Stillman Company, New York, deals with the hydraulic jacks and lifting tools manufactured by that company. This is known as sectional catalog No. 91, and supersedes catalogs Nos. 66, 68 and the jack section of No. 82. The catalog, besides describing the various hydraulic jacks, gives lists of repair parts and directions concerning the use of such jacks.

Electrical Instruments.—Bulletin No. 104, issued by the Wagner Electric Manufacturing Company, St. Louis, Mo., besides describing the different types of Wagner portable electrical instruments is intended as a manual of electrical testing. The book contains 48 pages and deals with a large number of electrical tests with diagrams included to show the various connections and the locations of the instruments.

Logging Locomotives.—Record No. 76, published by the Baldwin Locomotive Works, Philadelphia, deals with the logging locomotives for narrow and standard gage built by that company. These locomotives range from a 3 ft. gage, Forney type, with a total weight of 31,700 lb., to a Mikado type for standard gage track, weighing 174,600 lb. Several of the engines included in the description are designed for burning wood, and a great many of them are of the double end type. Several pages are also devoted to geared truck locomotives, and the illustrations bring out the construction of this type very clearly.

Twist Drills, Their Uses and Abuses.—This is the title of a small booklet which has been published by The Cleveland Twist Drill Company, Cleveland, Ohio. After an interesting discussion of the theory and design of the twist drill, a considerable part of the booklet is devoted to a discussion of experiments with drills of various shapes. This includes torsion and feed pressure charts, and discusses the difference in the shape of the groove, the form of chip as an index to a proper working drill, the effect of the angle of the point on the feed pressure, how the point should be ground, the importance of having the cutting edges at equal angles and of equal length, the importance of lip clearance, the cause of chipped cutting edges, the angle of lip clearance and the angle of the spiral. Several pages are devoted to drilling "helps and hints." Records of remarkable results which were obtained from a test of the Cleveland drill at the Atlantic City conventions in June, 1911, are discussed, and the booklet closes with a table of the revolutions per minute to secure different cutting speeds for various diameters of drills.